The FOUNDRY

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Castings Even Help Stop the Crack Flyer

SUMMER or winter, in daylight or darkness, the railroad train is controlled and protected on its journey from one terminal to the other by an intricate system of signals. Many collisions that occurred in the early days of railroading led to accident prevention study that resulted in the development of the first block signal system. This system was maintained by a signalman or operator at each station or tower, who would communicate by telegraph with the operator at the stations on either side to determine whether the track was clear. He set the signals to govern the train accordingly. Some time later the automatic block system was developed, chiefly to remove the human element, which still was blamed for numerous wrecks, and to cut down on the cost of keeping a man at the station at all times. The semaphore type signal first was used and is installed on many roads today, but on some railways the semaphore is being replaced by a series of lights which change position and color and thus indicate to the engineer whether he is to proceed, to proceed with caution or to stop. Castings find a place in the construction of the signals as well as in the extensive control apparatus used. Interlocking systems, another phase of train control, also use many castings.

Automatic Block Signals Protect the Century on its Fast Trip from the Shores of Lake Michigan to the Atlantic Seaboard

Find Where Castings Can Be Sold

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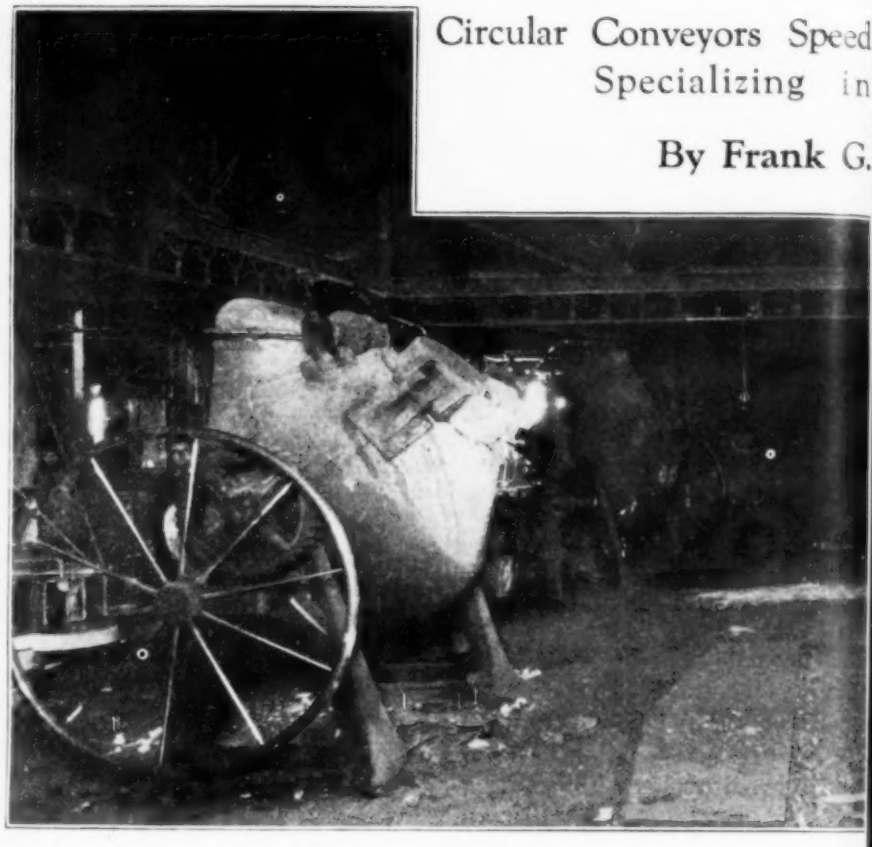
Making Nonferrous

Circular Conveyors Speed Specializing in

By Frank G.



THE dawn of the twentieth century found the railway lines of this country in a state of development. During the 40 years following the Civil war, a great network of railroads was constructed, an achievement not approached in the economic history of any other country of the world. In the late nineties, with nearly 200,000 miles of railroads in service, the construction era, the period of romance in railroad building came to an end.

Great increases in tonnages and a demand for more speed with safety caused railroad engineers to turn their attention to bettering existing equipment. Large sums of money were spent in devising better rolling stock and in designing and building motive power to meet the changing needs. Since many castings are used in the various types of operating equipment, foundries making this class of work encountered an increasing demand as the century progressed.

In 1900, Isaac Joseph, a dealer in metals in Cincinnati, organized the Edna Smelting & Refining Co., in that city, naming the new venture after his daughter. The name of the company later was changed to the Edna Brass Mfg. Co. The plant was built to smelt metals and to make repair castings in nonferrous metals for railroads. A few years later, as the business of the company increased, a machine shop was added and the firm started to make a line of finished material, including various types of injectors for locomotives.

As the demand for the equipment manufactured by the company increased, plant additions were constructed. However, no definite plan was followed in making the additions, and the new buildings were added where ever service conditions demanded. Various types of construction were employed and the buildings were of different heights and located on different levels of the company's property.

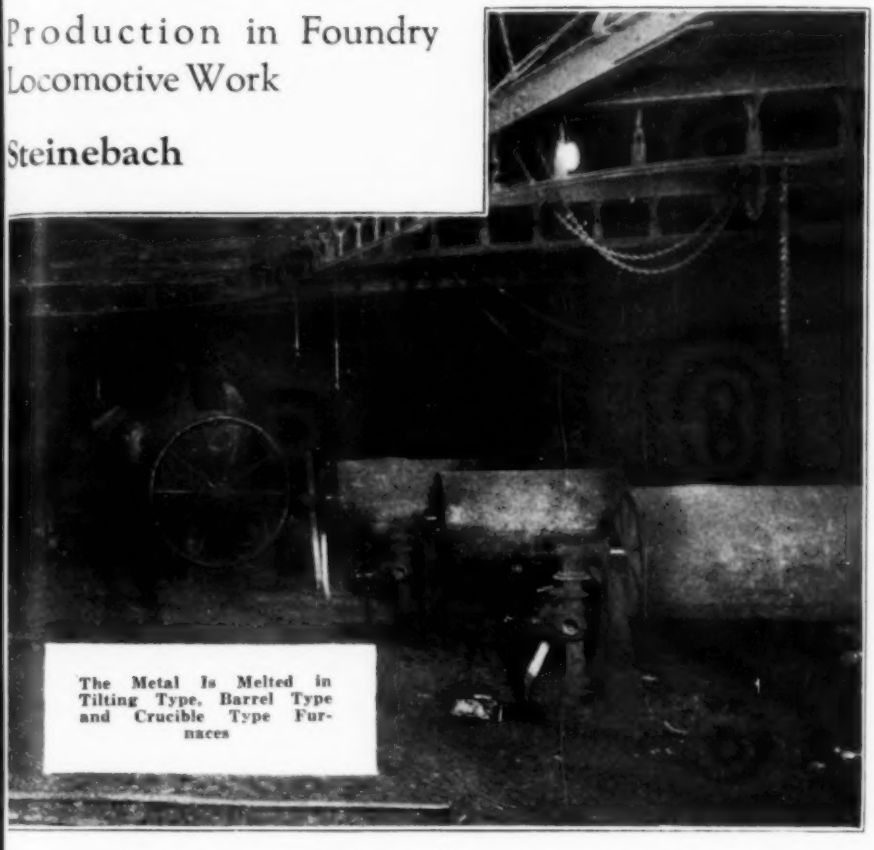
Benjamin I. Kaufmann, president of the Edna company, became connected with the firm in 1916, and began the reorganization of the various departments of the plant. The Edna company long had been known for

Fig. 2—The Merry-Go-Round System of Handling and Pouring Molds Increases Production and Decreases the Amount of Floor Space Required

Railroad Castings

Production in Foundry Locomotive Work

Steinebach



The Metal Is Melted in Tilting Type, Barrel Type and Crucible Type Furnaces

its quality of work. The management was confronted with the problem of rearranging the various departments so that this quality would be maintained, and at the same time the castings could be made on a production basis. Now, the various departments are arranged so that there is no back tracking of material as it passes through the plant from the receiving track where it enters as raw material to the shipping department where the finished products are delivered. Several new buildings were built, and others replaced, the molding floor was rearranged and equipment added to increase production. A new pattern shop and a new melting department were built.

Advantage has been taken of the location of the main foundry building on a hill. The hill slopes from the front to the rear of the building and also from one side of the building to the other, so that the front and one side is on one ground level, and the opposite side and the rear are on another ground level, one floor below. The molding floor, furnace room and cleaning department are located in the main building on the upper floor level. The building occupied by these departments is approximately 100 x 100 feet. The furnace room is built across a portion of the front of the building, and the cleaning department is partitioned off one side. The remainder of the floor space is used for the various molding floors. The receiving department for raw materials, the storage rooms, the core room and the compressor room are located on the lower ground level.

The castings made by this foundry are sold as rough castings and as finished parts for locomotives. About 33 per cent of the output of the plant is sent to the machine shop where the manufacturing processes are completed. The remainder of the castings produced are sold to various railroads in this country and abroad for repair work, or in the form of journal bearings. The products manufactured complete by the Edna company, and for which many castings are needed, include locomotive injectors, locomotive lubricators, water gages, water col-

Fig. 3—Large Injectors and Engine Castings Are Made on a Roll Over Machine and Carried to the Floor with Hoists Where the Cores Are Placed and the Molds Poured

umns, boiler check valves, line check valves, starting valves, journal bearings and engine bearings.

Production of nozzles, fittings and other parts to be finished in the machine shop, has been accelerated greatly by the adaptation of the merry-go-round system of stacking and pouring molds. Three circular pouring rigs now are in use, two of which are shown in Fig. 2. The two shown in the illustration are 14 feet in diameter and the third is 16 feet in diameter. The support for the merry-go-round consists of a steel shaft pivoted at the top and bottom and with manganese-bronze, spider like

FIG. 4—MOLDS ARE MADE ON BENCHES WHERE THE QUANTITY OF CASTINGS DESIRED IS SMALL

castings at the top and bottom. Horizontal steel channel sections are fastened to the radiating prongs on the bottom bushing while guy rods are suspended from the prongs on the top bushing. The lower end of each guy rod is attached to its corresponding horizontal channel near the outer end and the rods are tightened by turnbuckles to level the circular platform beams. The molds are carried on two circular steel beams, one of which is placed inside the other. Both of the beams are supported by the horizontal channel struts radiating from the lower bushing. The weight of the entire device rests on a manganese bronze ball, and the entire rig may be turned easily even when loaded. The conveyor is made in sections and easily may be assembled or torn down.

Molds for the two merry-go-rounds shown in the illustration are made on machines of the jolt-squeeze type, manufactured by the Wm. H. Nicholls Co., Inc., Brooklyn, N. Y. The cope and drag usually are made on the same machine from a match plate, although at times the drag is made on one machine and the cope on the other.

Each machine is operated by a molder and a helper, and the operations of the two men have been dovetailed in an interesting manner to speed production. The drag flask is placed on the machine by the helper, who then places a riddle on the flask and places a shovel of sand in the riddle. The sand is riddled around the pattern by the molder and the flask then is filled by the helper. The molder rams and strips the mold and lifts the drag to a bench in the rear of the molding machine. While the molder is setting the cores in the drag, the helper places the flask for the cope on the machine, after cleaning the matchplate with compressed air, places the riddle on the flask and throws sand in the riddle. The molder, who has finished placing the cores, riddles the facing sand in the flask and the helper fills the remaining space with sand. While the molder is ramming the mold and stripping the plate, the helper sets the drag on the merry-go-round. The molder places the cope on the bench and the helper places the flask for the drag of the next mold in place on the molding machine. While the molder is finishing the drag, the helper places the cope on the drag which already has been set on the circular conveyor. Little lost motion results from this series of operations, and the two men make from 160 to 170 molds per day, depending on the number of cores that must be set in each mold. The molds are stacked two high on the conveyor, as may be noted in the accompanying illustration.

The molds are weighted and poured by a special crew. The metal is carried from the melting room, which is located adjacent to the two circular conveyors, in ladles suspended from monorail hoists made by the Wright Mfg. Co., Lisbon, O., and by the Chisholm & Moore Mfg. Co., Cleveland. As may be noted in Fig. 2, a portion of the track forms a small arc of a circle parallel with the circumference of the conveyor. Instead of moving the loaded merry-go-round for each mold, the ladle is lowered to the proper height to pour the bottom row of molds and is moved from one mold to the next. Eight molds in the lower section are poured and the ladle is hoisted to a convenient height to pour the top row of molds. The ladle trolley then is swung back to pour the eight molds immediately above the molds on the lower section previously mentioned. The merry-go-round then is moved until 16 molds have passed the pouring section of monorail track and the pouring operation again is repeated. The use of the section of track instead of moving the mold conveyor each time saves time in pouring, for it is much easier to spot the ladle than to move the conveyor the exact amount each time.

After the merry-go-round has carried the molds to a point next to the sand pile, the molds have cooled sufficiently to be shaken out and the castings are taken to a department where the gates and risers are removed. The sand is riddled, new sand and water added and the prepared sand placed in a pile alongside to the molding machine. All sand in the foundry is riddled before being used in machines made by the Great Western Mfg. Co., Leavenworth, Kans. All empty flasks and bottom boards are placed on the conveyor and are ready for reuse by the molder and helper.

The use of the circular conveyors decreases considerably the space necessary for the molding floor, makes the handling of molds, sand and castings much easier and provides a place in the center of the device for the storage of bottom boards and flasks that otherwise would be in the way of workers. The company has found this equipment practical for the type of work being done, and now is planning the installation of a fourth conveyor to handle journal bearing molds.

The third mold conveyor at present is used to handle railroad bushing molds of various sizes. These molds are made on a jolt squeeze machine built by the Tabor Mfg. Co., Philadelphia. The mold is made in a one part flask. It is gated at the bottom of the flange and the sprue is attached to the pattern. After the mold is rammed, it is rolled over by the molder and the helper and the pattern is drawn by a magnet which is mounted on the crossbeam of the squeeze machine. A steel plate is mounted on the back of the pattern for this purpose. The molder brings this plate in contact with the magnet, vibrates the mold and then drops the mold away from the pattern. A slab core then is placed in the bottom of the mold, the mold rolled over and placed on the conveyor. Considerable blacking is used on the mold to make the casting easier to clean. Several sizes of bushings as well as other work of a similar nature are made on this machine, and three sizes of flat slab cores are carried in stock. The steel flask equipment in use generally at the shop was made by the Sterling Wheelbarrow Co., Milwaukee.

Five benches have been built along a portion of one side of the plant for the bench molding operations. Where the number of castings required is too small to make the use of the machines and the circular conveyors profitable, and where the castings are small and not mounted on matchplates, the molds are made at the benches shown in Fig. 4. Each bench is equipped with a vibrator. Sand is riddled by a special crew and is hauled to the various benches in wheelbarrows. Fine sand is used for smaller castings and coarse sand blended with the fine to suit particular conditions is employed for heavy work. The finished molds are placed on the floor immediately in the rear of the benches and are poured by the various molders from time to time.

Two jolt squeeze machines built by the Wm. H. Nichols Co., are located at the end of the shop opposite the melting department. These machines are used in making molds for journal bearing work. The drag is made on one machine and the cope on another. Each machine is operated by a molder and a helper, and the sequence of operations is much the same as in the case of the molds poured on the merry-go-rounds. Two castings are made in one mold and are gated in the drag at one end of the bearing. The sand for these molds is prepared and riddled by one crew, the castings are poured by another crew, and then are shaken out and hauled to the cleaning department.

The large injectors and engine castings are made on a rollover machine made by the Tabor Mfg. Co., and located along the side of the molding floor adjacent to the cleaning department. Both the cope and the drag are made on this machine from carefully matched plates. The molder makes a number of drags, which are carried to the floor at either the right or left of the machine, as may be noted in Fig. 3, where the cores are placed. Skim gates in the drag are used for these castings. One gate is sufficient on the smaller castings, while two or more are used on the larger castings. The matchplate for the cope is placed on the machine and the copes made for the drags already on the floor. The molds are carried from the molding machine to the floor by hoists suspended from a monorail trackway. The method of handling the molds from the machine to the floor and the method of handling the sand may be seen in Fig. 3.

Engine bearings also are made in a set of cast iron molds, which are located in the center of the foundry floor. Bearings of three different alloys are made in sizes ranging from 65 to 230 pounds. These molds are cooled with a blast of air directed on the mold through a metal pipe. The air for cooling the chill work is supplied by a blower built by the P. H. & F. M. Roots Co., Connersville, Ind., and located on the lower floor level.

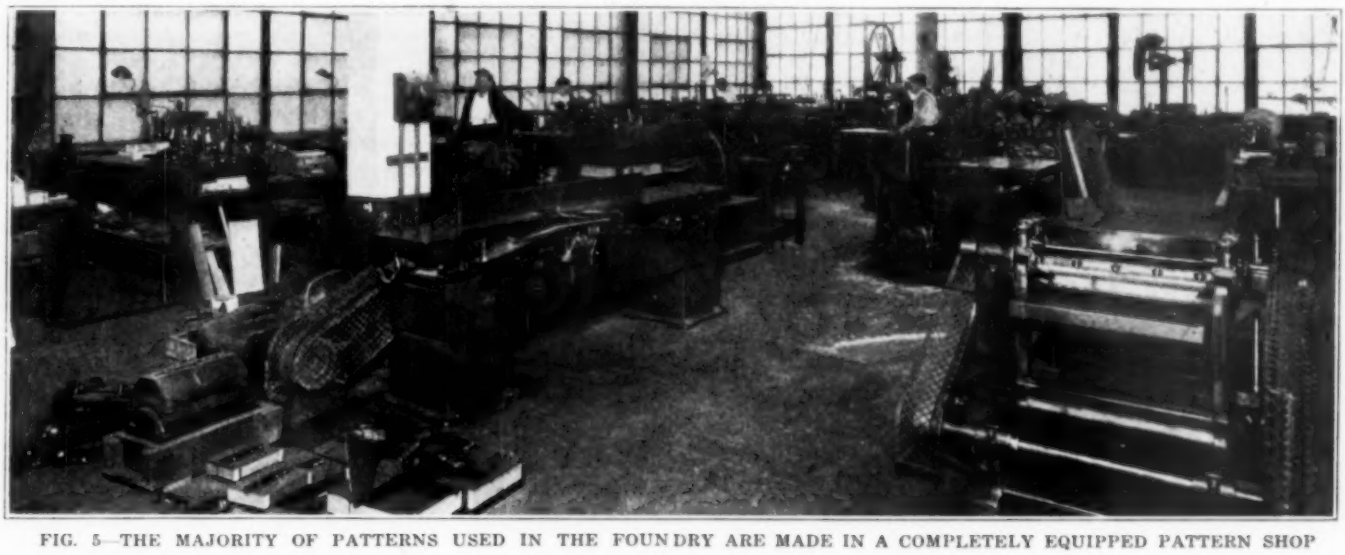


FIG. 5—THE MAJORITY OF PATTERNS USED IN THE FOUNDRY ARE MADE IN A COMPLETELY EQUIPPED PATTERN SHOP

Much work produced at this foundry requires cores. As may be seen in Fig. 7, many of the cores for the class of railroad work manufactured at this plant are exceptionally complicated. Another factor which adds to the coremaking problem is the necessity for great accuracy, since many of the castings must withstand heavy steam and water pressures, and a slight difference in the thickness of the core would mean a scrap casting.

The cores are made in a room on the lower floor level. The sand for the coreroom is mixed in a mixing machine built by the Blystone Mfg. Co., Cambridge Springs, Pa. The coreroom is equipped with 12 benches and one core machine with bucket elevator attached. The latter was

manufactured by Wm. Demmler & Bros., Kewanee, Ill. Many of the simpler cores which are required in large quantities are made on this machine. The cores are baked in two, gas-fired ovens of the rack type.

Since many of the cores are extremely complicated, for example the cores for the injector castings shown in the center and at the left of Fig. 7, it is necessary for the core department to receive the order considerably in advance of the molding department. Cores for the various types of castings, such as injectors, valves, etc., which are required from time to time, are kept in stock. One storage bin has 14 racks and each rack has 15 shelves, while a number of smaller storage racks are provided. A full line of stock cores from ½ to 5 inches in diameter inclusive and 12 inches in length are kept on hand at all times.

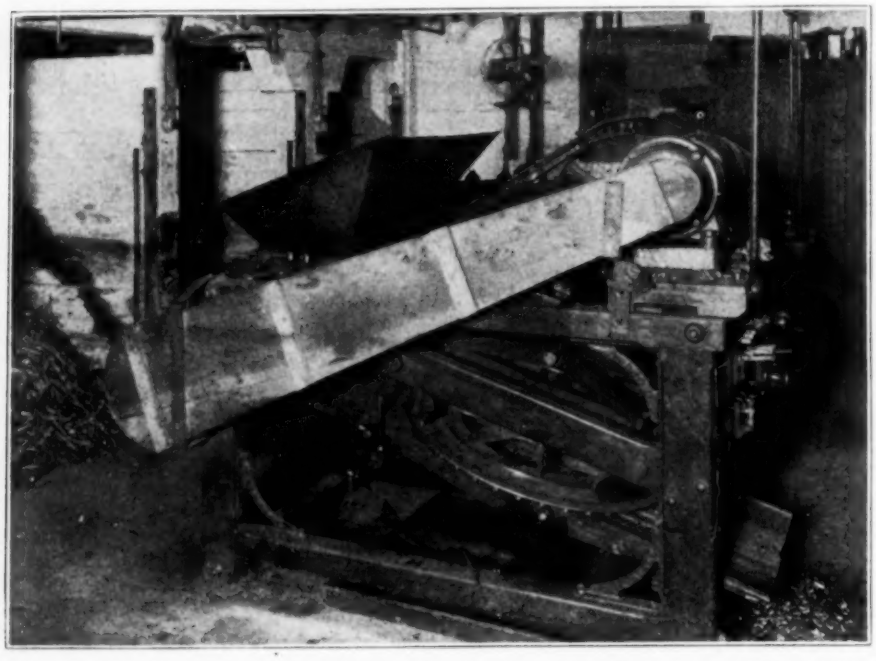


FIG. 6—BORINGS AND TURNINGS FROM THE MACHINE SHOP ARE RUN THROUGH A MAGNETIC SEPARATOR

Practically all of the smaller cores and parts of the larger types require wiring. Complicated cores, such as the injector core shown in the center of Fig. 7, are made in two parts. One half of the core is made and baked. The other half then is made directly on the half previously baked, the joint is made carefully, and the completed core returned to the ovens. This method of making the core assures an exceptionally smooth joint between the two halves.

The raw materials used in the plant are delivered on the house track in the rear of the main foundry building on the lower level. Sandblast sand, charcoal, ganister, molding sand and core sand are unloaded and hauled in wheelbarrows to the storage building located near the siding. The metal is purchased in special composition ingots. Each car of metal is sampled, drillings taken from the sample ingots and an analysis made. The ten ingots taken at random in the car are placed to one side after the samples are taken and are used last. In this way, if any question comes up concerning the analysis of the metal, another sample may be secured from the same ingots and another analysis made.

Castings spoiled in the machine shop, borings obtained by machining the castings in the machine shop and returned railroad scrap are practically all the scrap metals used. The returned railroad scrap, after being melted and run into ingots, is used in connection with new ingot metal in the production of journal bearings only. All borings from the machine shop are run through a magnetic separator made by the Dings Magnetic Separator Co., Milwaukee, before being used, and by this process any iron is removed. All spoiled castings are returned to the metal storage room, separated and placed in bins according to the chemical analysis.

Since the castings produced at this shop must meet specifications both for physical and chemical properties, as laid down by the American Railway association, great care is necessary in making the charges for the furnaces. To simplify this and to avoid the possibility of error, all alloys are designated by specific numbers, the composition of each number being controlled by a trained man in charge of the metal storage room. The heats are made under his direct supervision. All of the metal going to the furnace room is weighed and charged to the molding department, while the returned scrap also is weighed and credited to the molding department. After the heats are made up, the metal is taken on an elevator to the furnace room on the upper floor.

Use Oil and Gas

A portion of the melting equipment in the furnace room is shown in Fig. 1. The complete melting facilities comprise three Schwartz tilting type furnaces with a capacity of 2500 pounds each, four barrel-type furnaces of 600 pounds capacity each and four crucible pit furnaces. The Schwartz tilting type and the barrel type furnaces are fired with oil while the crucible furnaces are fired with gas. The crucible furnaces are used to melt manganese bronze, lead for lead gates and special mixtures where only a small quantity of castings are poured. Four gas-fired ladle heaters are used. The air for the melting units and for ventilating the furnace room is supplied by five blowers of the positive pressure type manufactured by the P. H. & F. M. Roots Co. The Schwartz type furnaces are relined once a year, although repairs are made every Sunday when the furnaces are used daily. Pyrometers are used in pouring all heats. The pyrometers were made by the Bristol Co., Waterbury, Conn., and the fire ends by the Thwing Instrument Co., Philadelphia.

The ventilating system used in the melting room keeps that department practically free from smoke and fumes at all times, and prevents the smoke and gas from reaching the molding department. Fresh air from the outside of the plant is forced into the furnace room at the rate of 22,000 cubic feet per minute. The inlets are located at the floor level at a number of points around the room. As the air is forced into the room, the smoke and gas are forced out ventilators at the top.

As shown in the illustration, a monorail system built by the Louden Machinery Co., Fairfield, Iowa, serves each melting unit, so that the metal in each furnace may be poured directly in a ladle suspended from the monorail on a hoist and carried to any one of the molding floors for pouring. The monorail system also serves all parts of the molding floor, with the exception of that portion used for bench molding.

After the castings are shaken out, they are hauled in wheelbarrows to

a point near the center of the molding floor, where the gates and risers are removed by a band saw or either of two sprue cutters. The cores are knocked out by a homemade device consisting of a pneumatic hammer mounted on a special steel frame. A few raps from the hammer quickly loosens the cores. After the gates and risers are removed, the castings are wheeled to the cleaning department and the shop scrap is returned to the storage.

The equipment in the cleaning room consists of a sandblast table and a sandblast barrel, both supplied by the Macleod Co., Cincinnati, chipping hammers, a swing grinder and four stationary grinders, the latter built by the U. S. Electrical Tool Co., Cincinnati. After the work has been sandblasted and chipped and ground where necessary, it is hauled to the shipping department. All work passing from the cleaning department is weighed. The castings to be sold rough are prepared for shipment, while the castings for the machine shop are sent to that department.

Tests Are Severe

Castings for injectors and other locomotive parts are given severe tests in the machine shop department. The lubricators, with a metal thickness as low as 3/16-inch are subjected to a water pressure of 1000 pounds per square inch, while the injectors and castings of this type are tested with a steam pressure of 300 pounds per square inch. Journal bearings are sounded for cracks and inspected for any defects. The bearings are lined in a special department located in another building, before being shipped.

A complete and modernly equipped pattern shop, shown in Fig. 5, is maintained. Practically all of the wood and metal patterns used in this foundry are made in the shop. Patterns for engine bearings and coreboxes for injectors may be noted in the foreground of the illustration. The pattern shop is located on the second floor of a new two-story building. The pattern storage is on the ground floor in a fireproof room, approximately 80 x 90 feet. The patterns are stored in steel racks and the building is equipped with an automatic sprinkler system. Approximately 6000 patterns are stored in this department and about 50 per cent of the patterns have coreboxes. Each pattern is numbered and a card file record kept of the numbers and the kind of patterns.

The method of keeping a record of the pattern while the work is routed through the shop is interesting. The order for castings originates in the machine shop or in the main office. If the pattern has to be made, an order is sent to the pattern shop. If the pattern is on hand in storage, the order is sent to the man in charge of that department. The patternshop keeper lays out the pattern and the corebox. The original order is attached to the corebox and is sent to the coreroom where the cores are made. After the cores are made, the corebox and the order are returned to the pattern storage and the original order is attached to the pattern. The foreman of the molding department then knows that the cores are ready for the job, and makes the castings. When the job is finished, the pattern is sent to storage with a ticket, one duplicate of this ticket going to the stockroom keeper and one to the shipping department. Rush work is so marked on the ticket. On all new patterns trial castings are made and carefully checked before the patterns are put into production. This is absolutely necessary on injector and lubricator castings which require an absolutely uniform distribution of metal due to the numerous cored passages.

Compressed air for the molding floor is supplied by two compressors located on the lower floor level of the foundry building. One compressor built by the Sullivan Machinery Co., Chicago, has a capacity of 625 cubic feet per minute. The second compressor, which is maintained for emergency operation, was supplied by the Ingersoll-Rand Co., New York, and has a capacity of 325 cubic feet per minute.

The flask equipment is kept in repair by a crew of two men. These men continually test the flask pins for proper alignment. When the hole for the flask pin wears slightly, the flasks are sent to the pattern shop where the hole is drilled out and a bushing inserted and cut off flush. The careful inspection maintained makes all parts of steel flasks interchangeable.

The foundry is heated by an oil burning boiler located on the lower floor of the main building. Steam passes through a series of coils located in a chamber and air is forced through the chamber by a fan. The heated air then is driven to the various parts of the plant through galvanized pipes. This heating system keeps the air circulating and at the same time distributes the heat evenly throughout the building.

Oil for the melting furnaces and the heating furnace is pumped directly from the tank car which may be spotted on the side track in the rear of the plant. The oil is pumped into two storage tanks, each of 11,000 gallons capacity. The oil is heated to 180 degrees in these tanks and then is pumped to the various departments of the plant when needed. In the winter it is necessary to heat the oil in the tank cars before it may be removed. The house track has a capacity for eight cars. W. M. Ball Jr., is foundry superintendent.

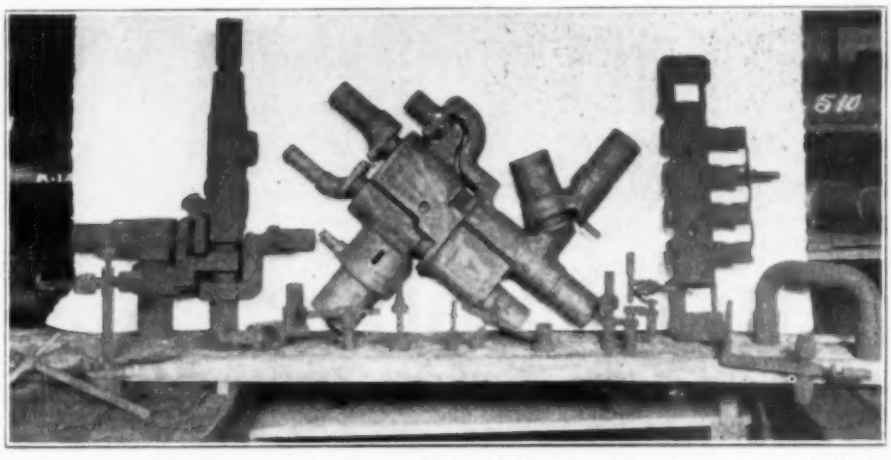


FIG. 7—THE COMPLICATED CHARACTER OF THE CASTINGS INCREASES THE PROBLEM OF COREMAKING

Pittsburgh Foundrymen Held Meeting

The regular monthly meeting of the Pittsburgh Foundrymen's association was held April 19 at the Carnegie Institute of Technology, at the invitation of Director Clifford B. Connelley and William H. Dosey. Dinner was served in the Carnegie Inn and was followed by a discussion by John J. Crowe, engineer, Air Reduction Sales Co., New York. The discussion was illustrated by oxy-acetylene cutting demonstrations and oxygen purity tests.

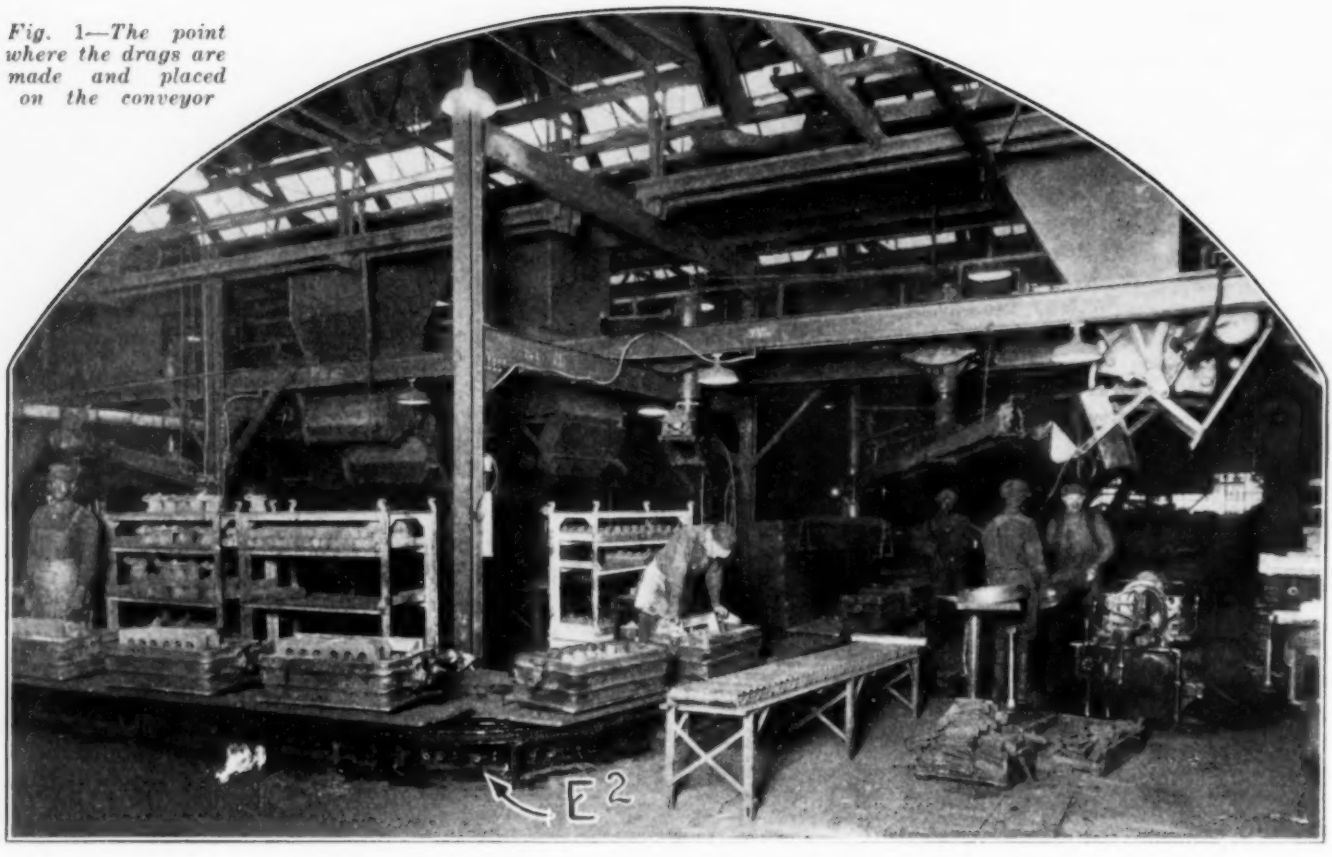


Fig. 1—The point where the drags are made and placed on the conveyor

Sand Supplied Continuously

SEVERAL interesting features characterize the recent installation of sand preparation and mold conveying units in the foundry of the Packard Motor Car Co., Detroit. As a result of this change in manufacturing operation the foundry has been placed on a continuous basis and in that manner brought into line with other departments of the extensive plant. Cupolas are run steadily and metal is supplied constantly of a uniform grade to meet the exacting requirements of high class automotive castings. Sand is prepared at one central point and this permits of a close accurate control, a uniform quality and a resulting uniformity in the castings produced in that sand. The system also provides for a definite method of adding new sand so that at all times it is properly bonded. The two extremes, rotten sand which will not mold properly, and over bonded material which represents a waste of new sand, are entirely avoided.

A gratifying measure of success has attended the innovation. The change from one method of handling the molds and castings to another was made over a period of several months and was carried out so skilfully that it presented practically no interference with the regular production schedule.

A description of the foundry and many of the methods employed appeared in THE FOUNDRY Feb. 15 and March 1, 1922. Therefore a brief reference at this time will suffice to visualize the general layout. The building has not been changed in any respect and the three main divisions of the foundry still retain their original position. Approximately a third of the floor space is devoted to the production of aluminum and brass castings. The coremaking department occupies an equal space in the center of the foundry and the remainder of the space is given over to gray iron casting activities A long, covered passageway on one side and extending the full length of the building, separates the operating department from a series of bins containing the various raw materials required in the production of ferrous and nonferrous castings. A somewhat similar, but wider chamber extending the full length on the opposite side of the main building serves as a casting cleaning and testing department. The foundry office in the center separates the gray iron cleaning room from the section where the aluminum and brass castings are cleaned.

No change has been made in the layout or methods in the aluminum casting department or in the extensive section in the center of the foundry where the cores are made and dried. In the third section elaborate mechanical equipment has been installed for handling the molds and castings on a continuous basis. Sand is prepared in a central piece of mechanism from which it is distributed to five molding stations that have taken the place of the long line of orthodox floors extending from the gangway to the wall.

Under the new dispensation the cylinder molds are made in the space between the sand preparation plant and the coremaking department. The equipment is not yet complete for the conversion of the eight-cylinder block from dry to green sand. These castings still are made in the original manner in dry sand molds. The molds are taken from the ovens, cored and assembled on a vacant floor in the vicinity of one of the conveyors on which small miscellaneous castings are made and which will be described more in detail later.

Formerly all cylinder blocks were cast with the barrels in a vertical position. The *eight* still is cast in that position and will continue to be so cast until, as just stated, the pattern and flask equipment for the new

method have been prepared. In the meantime the plates on the conveyor are of the proper dimension to take the larger molds when the time arrives.

The pattern for the six-cylinder block has been changed and split

Fig. 2—Second corner of the conveyor where the copes are placed on the drags

through the center so that it may be molded in a two-part flask with the barrels in a horizontal position. With possibly one exception this is the method pursued universally in American automotive casting shops. Formerly the casting was poured through a number of small gates surrounding each of the core prints and connected to a long basin on top of the cope. Now the iron enters the flask through an upright gate back of the carnkcase core and is distributed through a number of small flat gates entering the lower flange. Up to the present no figures are available to determine whether this system of gating is equal, inferior or superior to that which it has displaced. At the time of this present writing early in April the new system of making the molds only has been in operation a month and since minor adjustments were required from time to time, any sweeping conclusions would be unjustified.

Equipment for preparing the sand and handling the molds on a continuous basis was designed and installed by the Osborn Mfg. Co., Cleveland, and represents the culmination of a rounded out engineering service confined for many years merely to the production of molding machines. Realizing the important relationship existing between the three most important factors of production, the molding machine, the equipment for preparing and supplying the sand and

Fig. 3—Two elevators feed sand to a measuring belt that loads the bar mill

auxiliary equipment for taking the flasks away from the machine as fast as they are made, the Osborn company finally evolved the combination of which the installation in the Packard Motor Car foundry is the latest and most complete operating example.

One of the most interesting features in connection with the installation of this extensive equipment is that it was done without interfering to any appreciable extent with the normal operation of the foundry. Plans were prepared and all necessary arrangements made in advance so that when the shop shut down for the usual two weeks inventory taking in August, the construction gang swarmed into the place like a flock of locusts and dug a series of tunnels and crosscuts from the end wall to the gangway that separates the core department from the cylinder molding floors.

An opening was made in the end wall for the entrance of a steam shovel which then dug a gradual descent for itself to a point where the actual excavation was required. From this point the material was removed to a uniform depth of 8 feet, as shown in the accompanying illustration Fig. 4 for one main tunnel 240 feet in length, one 90 feet, one lateral tunnel 50 feet, one 30 feet and a longitudinal excavation on the outside approximately 70 feet in length commencing at the full depth at one end and gradually slanting upward to the ground level at the other end. Considerable miscellaneous excavating also was done for foundations under the hoppers and mixing apparatus.

The first of these tunnels houses the belt which returns the sand from the shakeout stations serving the four conveyors to the mixing and rejuvenating station. The second tunnel is located at the opposite end of the system and performs a like service for the sand in the cylinder molding unit. The two lateral tunnels are located below the floor in the space which separates the two pairs of small conveyor units. A belt in one tunnel feeds the sand from the shakeout on

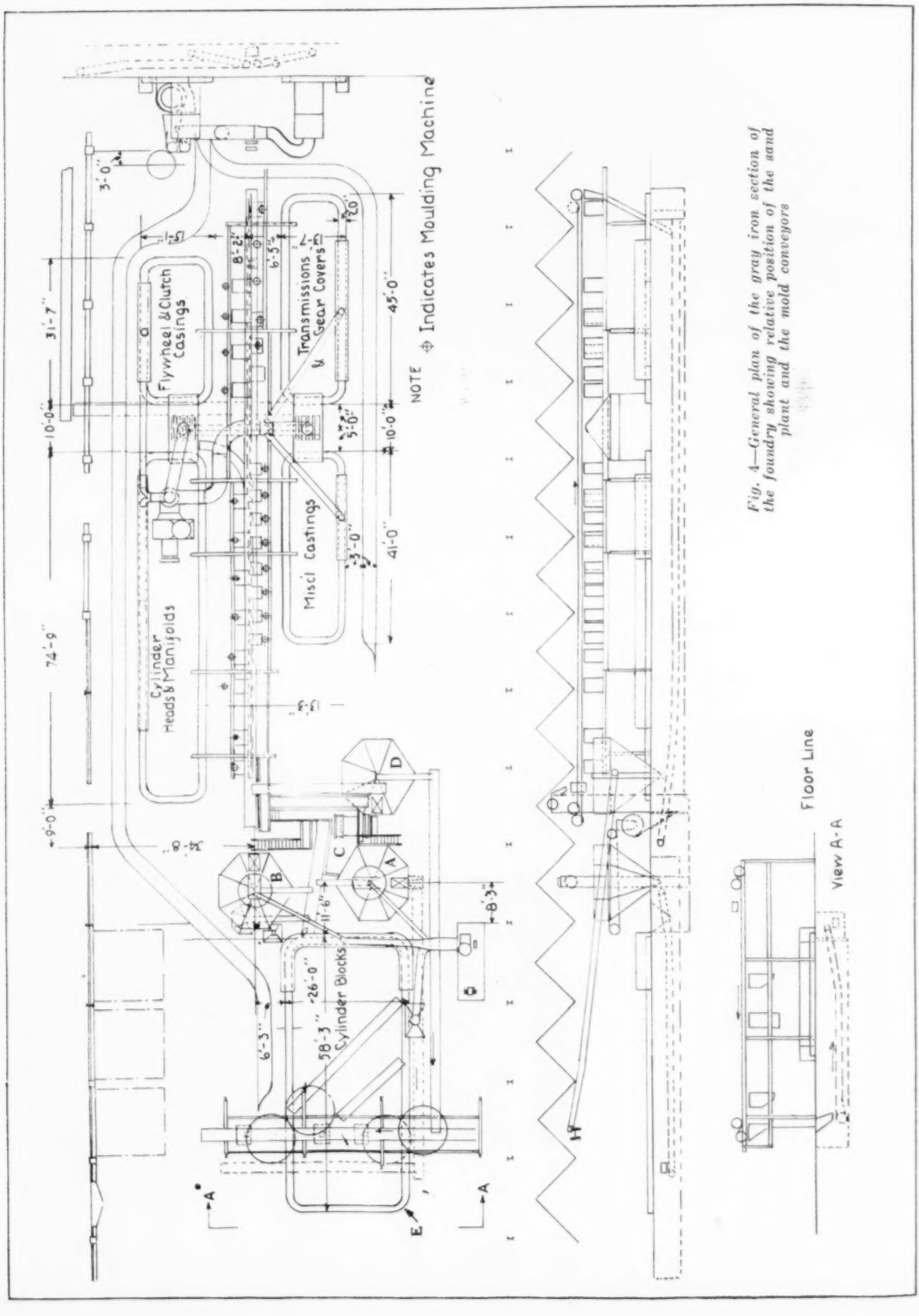


Fig. 4—General plan of the gray iron section of the foundry showing relative position of the sand plant and the mold conveyors

to the main return belt mentioned previously. A steel plate conveyor in the other tunnel carries the casting through an opening in the side wall of the building where they fall on to the fifth and last conveyor as shown in Fig. 6.

Concrete men followed the shovel with forms for retaining walls and foundation pillars. The work was pressed forward so diligently that all the underground construction was finished by the time normal operation was resumed at the close of the inventory period. The superstructure which includes the various conveying units on which the molds are assembled and poured, also the overhead, sand conveying mechanism and the monorail system for handling the molten iron were assembled and installed gradually so that at no time did they interfere seriously with the normal production of castings according to methods previously in vogue. A pair of machines or a floor of molds had to be shifted occasionally, but the change was only temporary and imposed no handicap. With the foundations already in place the various molding machines were shifted easily to their new location when the time arrived to set them in position according to the new dispensation.

Original plans and specifications contemplated two distinct sand handling systems, one dry sand for the cylinder molds and the second green sand for the remainder of the castings. This to some extent explains the presence of two main reception sand bins as shown in the reproduction of the general layout drawing, Fig. 4. Final revision of the plans definitely settled on green sand as a molding medium for the cylinders. Therefore, a variation in the sand mixture no longer is required. The two bins now are arranged in such a manner that the sand from either one may be diverted if necessary to the other. Outline plan and side elevation of the sand preparation plant is shown slightly to the left of the center in Fig. 4. For convenience in reference, the principal parts have been marked. Thus *A* and *B* are the two bins into which the sand is dumped on its return from the shakeout stations. *C* is the bar mill where the sand is blended and renewed and *D* is a 60-ton capacity bin from which the prepared sand is distributed on suitable belts to the various 4-ton hoppers located above the molding machines at each of the five units devoted to the production of castings.

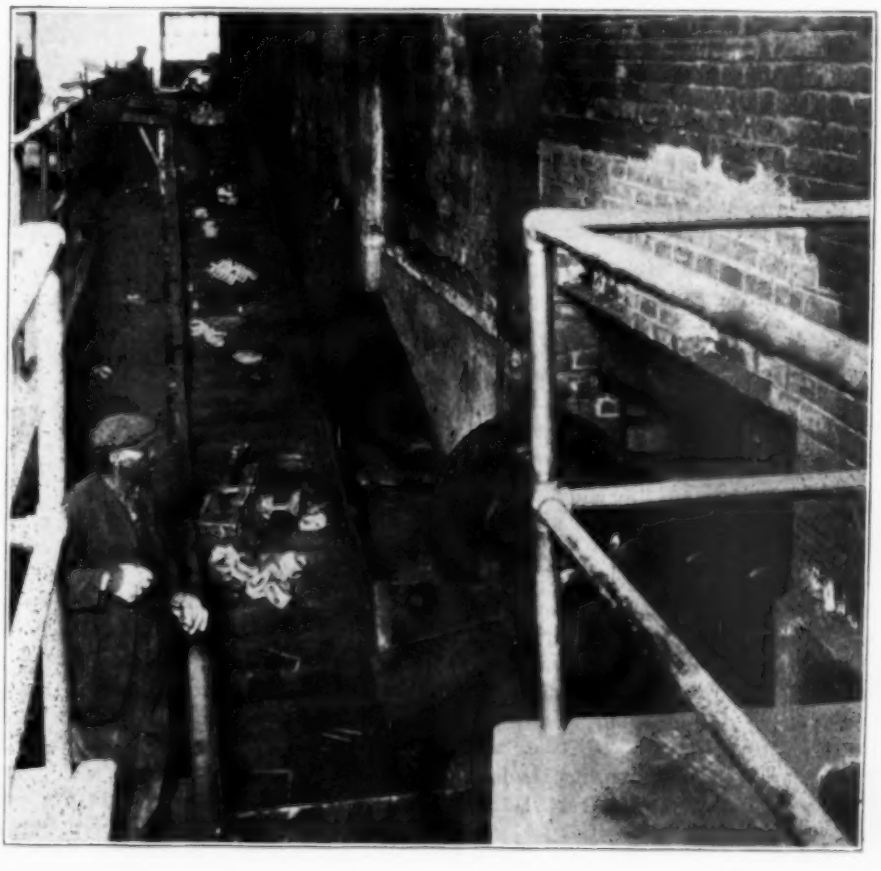
From the foregoing, it may be noted that the sand preparation plant is the

Fig. 5 — Above — Showing part of the sand distribution system over the small conveyors

central feature of the installation. It occupies a position that is both the beginning and end of the cycle and is responsible for the successful operation of the entire gray iron section of the foundry. A single attendant looks after all the equipment and maintains a sensitive control over the sand distribution through a control panel within easy reach from his station on a steel bridge located over the roller mixer. From this strategic point he can see the sand both coming and going and can start or stop any one of the various pieces of equipment at any time without interfering with the remainder of the units.

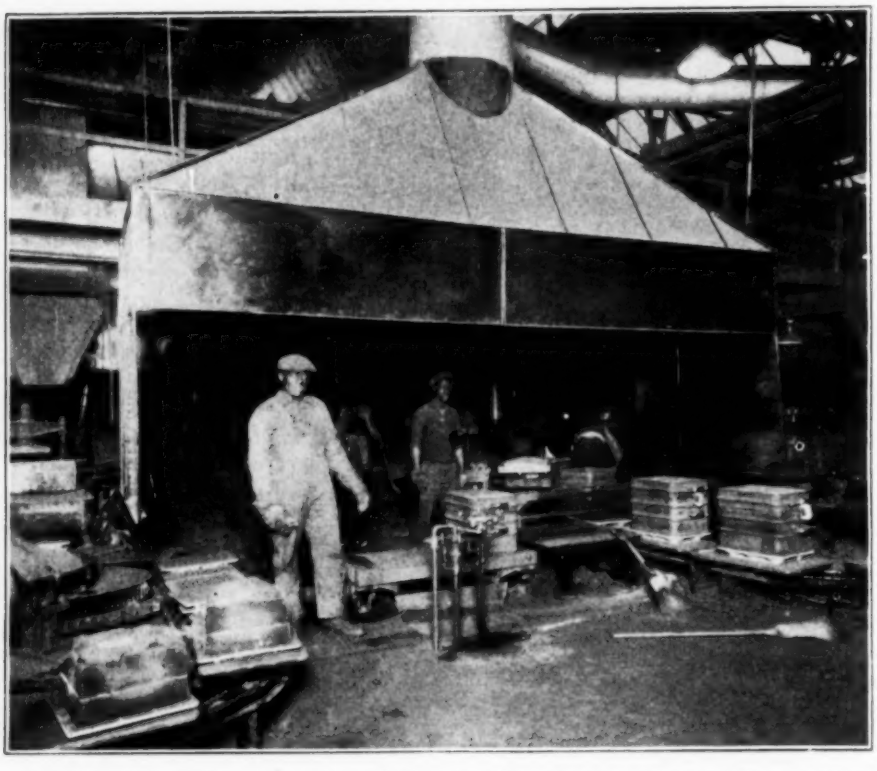
Contrary to a somewhat popular conception of sand distribution systems, flexibility of operation is entirely feasible. Variable speed motors provide a ready means for increasing or decreasing the amount of sand that is

Fig. 6—Below—The final conveyor in the series carries the castings to the loading stage



handled in the mixing mechanism and in that manner the amount that is passed through the molding stations. At its lowest operating capacity the system is designed to provide sand for all the gray iron castings made per day for 150 cars. Geared to the second speed the system will take care of the gray iron casting requirements of 185 cars. At the third speed the system has been designed to take care of the castings for 250 cars a day.

The manner in which advantage was taken of the roof construction to accommodate the loftiest part of the sand mixing equipment is shown in the side elevation Fig. 4. Also it may be noted that the two main belts



supplying the molding machine hoppers run closely under the lower points of the roof trusses. This type of roof was selected when the foundry was built. It simply is a succession of immense window sashes filled with wire glass and supplies ideal illumination to the floors below. Incidentally, it may be noted that the side walls are built of brick and are not pierced for windows.

In describing a continuous performance one cannot lay a finger on any definite point and say, "Here is the beginning" or "Here is the end." Obviously, a start must be made at some point if the description is to be intelligent or coherent. In conformity with our system of reading from left to right, attention is directed to the point marked *E* in Fig. 4. A photographic view of the same locality is shown at E^2 in Fig 1 the beginning of the six-cylinder's journey around the circuit.

Drag molds are rammed on a roll-over jolt machine shown to the right in Fig. 1. Sand is supplied from a 4-ton overhead hopper provided with a chamber in the bottom that automatically measures the correct amount of sand required to fill the flask. In this manner the sand in the hopper is conserved and the amount of spilled sand on the floor is held to a minimum. The small amount of sand that inevitably is spilled falls through a grating upon a continuation of the main belt that passes under the shakeout station and is carried back to the central sand mixing station.

Empty flasks are placed by hand on the molding machine, but a small air hoist suspended from a pivot is employed to place the rammed mold on the drag conveyor close by. A supply of cores arranged in proper sequence is kept on racks close to the conveyor and the various operators place these cores in the molds as they pass along.

Drags with complete sets of cores in place are shown in Fig. 2, a view taken of the second outer corner of the same conveyor. Copes are rammed on a combined jolt and squeeze, pattern-drawing machine located inside the corner of the conveyor and supplied with sand from a hopper similar to that located above the drag machine. Two small air hoists are provided for handling the cope. One is suspended from a jib and is used to lift the copes from the machine and place them on a stand where they receive a little hand finishing, vent holes are poked through, etc. The second hoist is suspended from a monorail and is used to pick up the copes and place them on the drags. This arrangement of hoists with several copes always in reserve forms a flexible link in the chain and serves to take up any slack in synchronization of operation.

Iron is brought from the cupolas in 1000-pound ladles suspended from a monorail and the molds are poured immediately after they have been closed and clamped. Then they enter a covered section of the conveyor which encloses the entire end and extends a short distance over both long sections. The canopy is connected to a powerful exhaust system which removes practically all the steam and smoke before the molds round the fourth turn on the conveyor and approach the shakeout station.

The shakeout equipment presents several novel features. A substantial

Fig. 7—One shakeout station serves two conveyors

steel grating 3 x 5 feet made of flat bars ¾ x 4 inches spaced 1 inch apart with suitable blocks at the ends, is mounted close to the conveyor and flush with the surface. Each end is mounted on a small plain jolt molding machine.

The end of the piston rod in a 6-inch air cylinder mounted horizontally on the inner side of the conveyor engages each flask in turn as it approaches and pushes it off on to the grating. The bottom plates remain on the conveyor. The attendant opens an air valve which admits air to both jolting cylinders, but since they operate at different speeds the grating is jolted independently at each end and in this manner the flask is jolted more rapidly and violently than otherwise would be the case.

The drag flask is returned to the power conveyor which carries it on to the drag molding station. The cope is placed on a roller conveyor and taken to the cope ramming station. The castings are loaded in trucks which convey them to the cleaning room and the sand falls through the grating on to a

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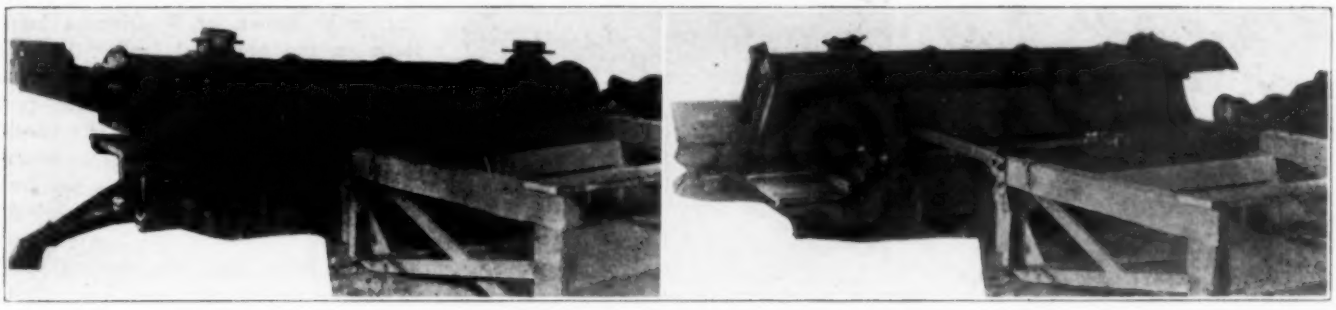


Fig. 1 (Left)—Casting Machine Closed for Pouring. Fig. 2—(Right) Top Opened to Insert Flask

Cast Pipe Centrifugally

Recently Completed Plant of the American Cast Iron Pipe Co., Birmingham, Makes Pipe in Metal Molds Lined With Sand

REFRACTORIY lined metal molds are employed by the American Cast Iron Pipe Co. for cast iron pipe made centrifugally in a new plant recently completed at Birmingham, Ala. Ordinary grades of pig iron available in the Birmingham district are used in the process. As there are no risers or gates the amount of return scrap is nominal. Standard by-product coke is used for the melting and modern cupola practice is followed in reducing the iron to the fluid state.

The complete plan of the iron yard and cupola plant which supplies melted iron to the new centrifugal plant, as well as to the old sand cast foundry, is shown in Fig. 5.

Red loam molding sand from the Montgomery, Ala., district is used as a base for the mold lining and a sufficient amount of washed silica sand is added to produce a molding sand of the proper specifications in amount of bond, permeability, moisture and grain size. The chief bond of the molding sand comes from the red loam, but yellow field clay, fire clay or liquid core binder also are applied to the sand in the form of a thin wash to give additional bond to the sand in the green state.

Sand face of the mold is faced with ordinary pipe foundry facing made from nut coke pulverized to the consistency of flour. Sand used for making the socket cores, which form the inside of the bell of the pipe, is a fine grained washed silica sand similar to that used in making oil cores for radiator castings. This sand is mixed with linseed oil.

Coal tar for coating the pipes is bought on a specification governing its content of moisture and free carbon, and is delivered to the plant in tank cars of approximately 10,000 gallons capacity. It is pumped from these tank cars into storage tanks and removed from there to the dipping vats as required.

Molds are made in cast iron flasks machined on all points accurately to facilitate repetition work. The sand mold must be rammed perfectly concentric with the spinning surfaces of the flask.

For convenience in reference, the steps in the process have been numbered consecutively on the drawing shown in Fig. 5. Empty flasks come down the run as indicated at 2 and are received on a tilting table in the run which delivers them into the vertical position on the ramming stations 1 as shown at 3. The flasks are handled three at a time and two ramming stations are used alternately so that while the men are ramming on one station, others are completing the rest of the work and making the change on the second station. Once the flasks are properly located on the ramming stools the three patterns are lowered into place by a stationary pattern hoist. Pneumatic rammers are lowered into the individual flasks. Sand is delivered through chutes. Patterns are drawn three at a time from

Invents Process

W D. MOORE, president of the American Cast Iron Pipe Co., Birmingham, Ala., is the inventor of the casting process by which cast iron pipe is to be made at the new plant. Mr. Moore has been connected closely with the foundry industry since 1908, *and has been president of the American Cast Iron Pipe Co., for the past two years. He was born at Hannibal, Mo., April* 17, 1882 *and was educated in the public schools at Galion, O. He was graduated from the Galion high school in* 1900 *and became connected with the American company in* 1908 *as an engineer.*

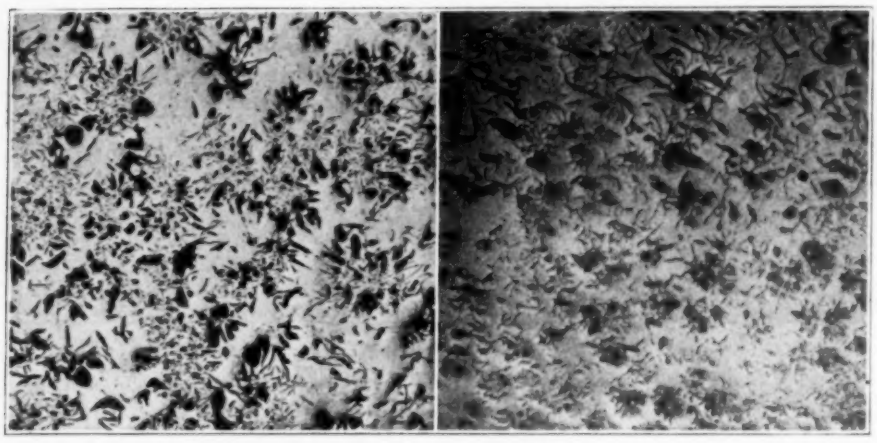


FIG. 3—(LEFT) PHOTOMICROGRAPH OF CENTRIFUGALLY CAST PIPE STRUCTURE AT OUTER EDGE. FIG. 4—(RIGHT) SAME RELATIVE POSITION ON SAND CAST PIPE

the molds. The molds are lifted from the ramming stools by a hydraulic lift and wet blacking is applied to the face of the molds while in a vertical position. They are then returned to the horizontal position by the tilting table and are ready to move forward on the flask run as indicated at 4. The flasks then proceed to 5 where they are picked up by an overhead crane 6 and delivered to the casting machines at 7. In this operation the flasks are handled two at a time by a special device attached to the crane.

The top half of the casting machine, as shown in Fig. 2, is elevated sufficiently to allow the flask to roll in. The machine then is closed and the motor is attached to the flask by a quickly detachable clutch. The proper amount of iron is placed in the pouring ladle shown at 9, from a large ladle on the monorail trolley 10. The machine then is inclined to the proper angle and the pouring operation proceeds. Immediately after the metal is poured the mold is set spinning and the iron is distributed on the wall and held there in the form of a tube until it is sufficiently set to retain its shape. Then the machine is shut down.

Only 10 Minute's Required

The mold and pipe are rolled on through the machine to the position shown at 11. From this station they are moved to 12 where the end trimmings are removed from the flask and the socket sand removed from the bell end of the pipe. All of this, including the casting and spinning operation, takes place within 10 minutes.

Flask, sand and pipe pass to the tilting stripping machine shown at 13. The flask is tilted and held until the sand is removed. The flask and pipe are returned to the horizontal position and the pipe puller at 15 removes

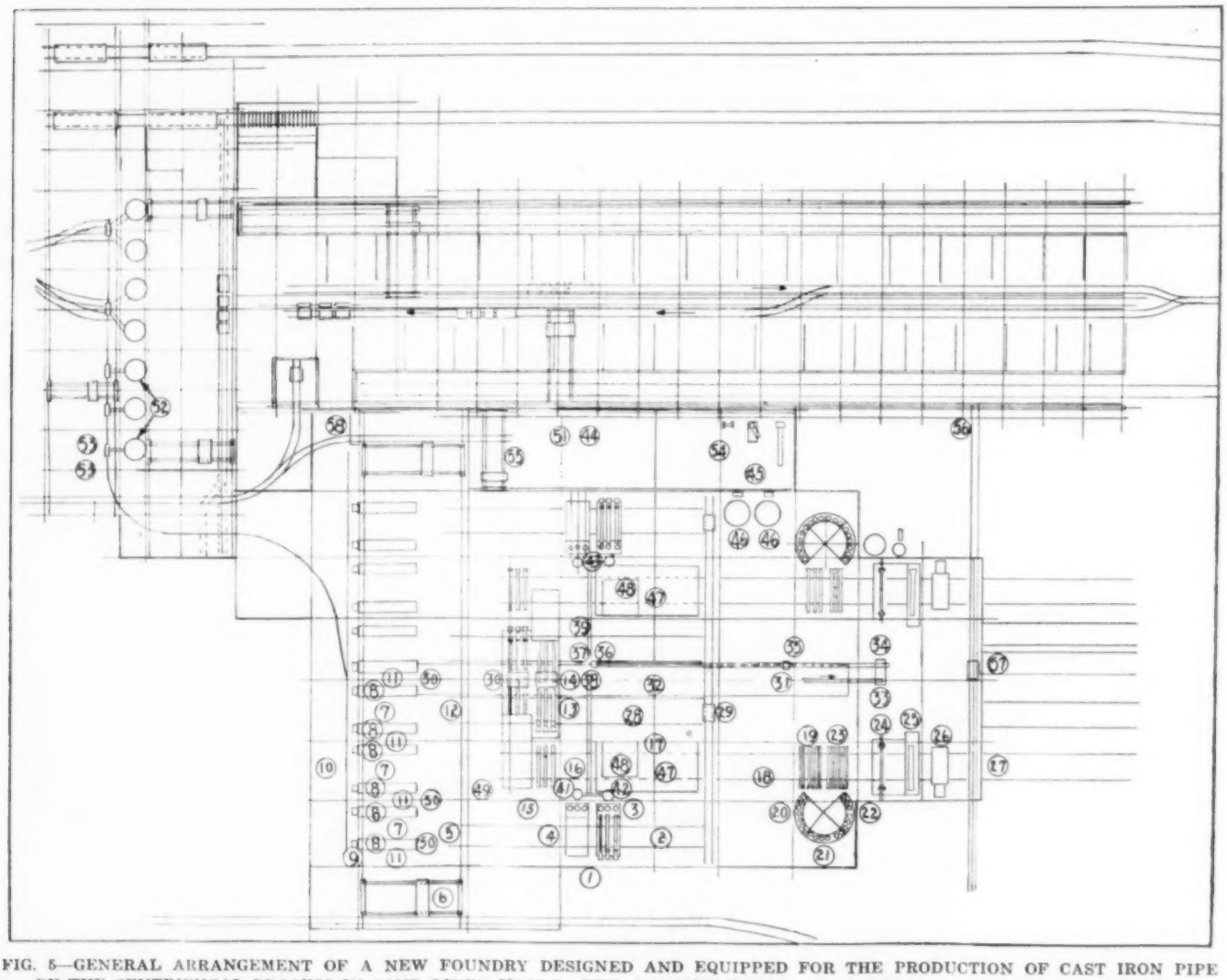


FIG. 5—GENERAL ARRANGEMENT OF A NEW FOUNDRY DESIGNED AND EQUIPPED FOR THE PRODUCTION OF CAST IRON PIPE BY THE CENTRIFUGAL PROCESS IN SAND LINED MOLDS. THE VARIOUS POINTS OF INTEREST HAVE BEEN NUMBERED ON THE ILLUSTRATION FOR CONVENIENT REFERENCE IN THE TEXT

the pipe from the flasks three at a time and deposits them on the run at 16. A conveyor immediately takes the pipe into a cooling oven at 17.

A slow moving conveyor gradually rolls the pipe through the oven, where it is kept under temperature control for approximately 40 minutes. At 500 degrees Fahr. it is ready to be removed from the cooling oven and enter the cleaning department shown at 18.

When the pipe is cleaned it passes to station 19, where it is picked up by a small hoist and passed to station 20 where it is lowered into a bath of tar and held a sufficient time to take proper coating. The bath itself is under temperature and chemical control. Pipes then pass to 21 where they are permitted to drain free of surplus tar and then pass to 22 where they continue to cool. They then pass to station 23, where they are lowered to the pipe run again and proceed to the hydraulic testing press 24. Gas pipe are not coated but after the test in press 24 they pass to press 25 where they may be given an air test of 25 pounds air pressure under water. From here they pass to station 26 where they are weighed and the individual weight marked on the outside and inside of each pipe. Then they pass to 27 where they are picked up by a monorail hoist, or truck, and distributed on the loading yard as a finished product.

From station 13 the empty flasks proceed down the run to 28 and then to transfer car 29 and are taken across as shown by the arrow, to flask run 2, and then proceed through the ramming station again in their regular turn.

Two units operate entirely independent of each other, except that they have the same sand handling and preparing machinery and the same source of iron supply. Sand tempering and regenerating starts at station 14 and 30, the dry storage bins, where the sand is accumulated as it is removed from the flasks during the stripping operation.

Underneath the bins a reciprocating sand conveyor takes the sand from the bins 14 and 30 to 31 at a predetermined rate, which is controlled by slide valves and the stroke of the reciprocator. Sand enters the reciprocator almost, if not entirely free of moisture, and at a temperature of approximately 125 degrees Fahr. Water is added between stations 14 and 32 to bring it back to molding temper. New sand is added at station 32.

At 31 the sand is delivered by the reciprocating conveyor to a belt conveyor running at an angle of about 30 degrees, and which elevates the sand from the basement to a point above the working floor level and delivers it into a duplex paddle mixer at 33. Any additional water or clay wash, or any other material is added at this station.

Sand is delivered from the end of the paddle mixer at 34 on a belt conveyor operating at an angle of approximately 30 degrees. This belt elevates the sand to station 35 and discharges it on to a vibrating screen which mixes and aerates the sand and delivers it on to another belt conveyor operating at an angle of approximately 30 degrees. The lower end of this belt conveyor is approximately 6 feet above the shop floor level. This belt extends from 35 to 36 and on account of the inclination, station 36 is well up into the third floor of the shop.

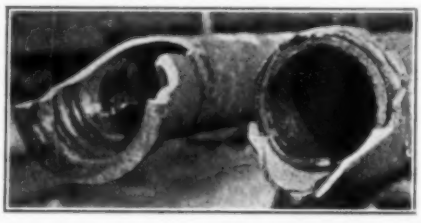


FIG. 6—FRACTURE RESULTING FROM CROSS BENDING TEST

Sand Is Tested

Test samples are taken between 35 and 36 and a check is made for moisture, permeability and bond. The screen test also is made from time to time to keep the grain size under control.

Equipment is provided along this belt conveyor for adding water to the sand, should the test indicate the necessity. In actual practice the sand is run a little on the dry side coming through the mixers 33 and 34 to avoid ever having it too wet as it comes on to the belt at 35.

At 36 the sand passes on to another vibrating screen which further mixes and aerates it, and breaks up any accumulation of moisture as a result of applying water to it on the belt. The sand then drops into a circular revolving bin 37 where a nominal storage of tempered sand is kept.

An automatic feeding device in the bottom of this bin delivers sand to cross belts 38 and 39 simultaneously or separately. From station 38 to 40 an inclined belt conveyor elevates the sand from the bottom of bin 37 up into a chute which delivers it to bins 41 and 42. As the sand travels from 38 to 40 on the belt it is again sampled and tested for moisture. This belt also is equipped with water facilities to add moisture if found necessary.

Sand bins 41 and 42 of the revolving type with automatic feed at the bottom are located immediately over the ramming station as shown in the drawing, and deliver sand into the flasks as required during the ramming operation. Construction from 39 to 43 inclusive is a duplication of the construction from 38 to 40 and serves the opposite ramming station.

Raw materials, sand, facing, clay, etc., are stored at 44 in the basement of the shop. A pair of vertical skip hoists at 45 handle a half yard bucket each from the basement floor of the building up through the first floor and delivers the load into the mixing mills on the second floor, as shown at 46.

Materials for mold linings are taken from the storage bins in the basement and loaded in predetermined proportions in these skip hoist buckets. The operator running the mixers operates the hoists and delivers the charge into the mills where it is throughly mulled, and receives the proper amount of moisture to bring it to temper. Oil sand mixture for making the socket cores also is prepared in the same apparatus.

An electric storage battery lift truck delivers the sand to the molding and core making stations. The core ovens 48 utilize the waste heat from the hot pipe as they pass through the cooling ovens. They also are equipped with gas burners.

Socket cores are removed from the ovens with the lift truck and transported by way of a platform to 49, where an elevator lowers the truck to the first floor at 50 where they are used in the molds. Empty racks are returned to the second floor by the lift truck and elevator.

Liquid facing is discharged from the mixer into a container and thence through a piping system to the ramming station, where it is always available for facing the molds. The facing is distributed by a special dasher rigging inserted in the mold and holding a predetermined quantity. The facing spreads over the surface of the mold as the dasher descends and drains into a receptacle at the lower end of the mold.

An I-beam trolley system, as shown on the drawing, extends from the cupolas to the twelve pipe casting machines.

Ladles of hot metal holding about 4 tons, are picked up at the cupola station by the monorail hoist and used to fill the pouring ladles at the individual machines with the proper

(*Concluded on Page* 363)

Why Is Gray Iron Porous?

Conclusions Based on Years of Experience and Observation in Gray Iron Foundry Practice Presented

By Herbert M. Ramp

MANY defects in gray iron castings listed under the title of porosity have their causes autographed upon them and it is easy to diagnose the trouble and prescribe a remedy. If the porous spot contains slag, dirt, or sediment of any description, there is tangible evidence which can be traced to its orgin.

The defects that cause the founder anxiety, are those which present no symptoms or earmarks to explain their presence. A cavity that contains slag or dirt carries it own explanation. One that contains nothing opens a wide field for conjecture and investigation.

Many reasons including methods of gating, risers and absorbed gases have been given for porosity in gray iron castings. Many explanations have been made in the effort to trace this invisible agent to his lair and progress has been made in a reduction of losses due to this complaint.

Aside from the forms of this defect patent to any foundryman, two varieties are prominent, the smooth hole of any shape and with no residue, and the jagged crystalline cavity or spongy spot that causes so much distress when sound castings are required to withstand pressure. The smooth hole is caused by gas. Where it comes from always has been open to debate in the foundry. The molder blamed the core maker, the core maker blamed the molder and now they both charge it up to occluded gas in the iron.

We often have heard that gas taken up or absorbed by the iron in the cupola during the process of melting and released during the cooling down or freezing period when in the mold causes these gas pockets or blow holes. The average foundryman neither can affirm or deny this point. He has no means of determining if it is true. He cannot prove there is gas in the iron before he pours it.

If it is true he works under a heavy handicap. He cannot tell whether a casting will be sound or defective, full of blow holes or perfect. Neither advice or remedy is offered to help him. If iron really absorbs gas in the cupola and releases it in the mold he has as elusive a disease to fight in cast iron as the doctors had to fight in the human body during the flu epidemic a few years ago. This mysterious gas presents one virtue it gives him a beautiful alibi when he produces castings full of blow holes.

Cast iron never has practically demonstrated to the layman that it absorbed gas in the cupola during the melting process. Further it is irrational to suppose that gas would release itself in one kind of a casting and not in another. Four castings poured in the same mold on the same gate may show two with blowholes and two without. When blowholes exist in a casting the foundryman knows that at least one of several factors is responsible. The sand was too wet or too close or the cores were not made or dried properly. This condition caused an excess of steam or gas to be formed which could not pass readily through the pores of the sand or the vents provided. In trying to force its way out through the molten metal, the gates and risers, the path of least resistance, some of the gas was trapped because it could not get through before the iron cooled.

Gas comes from the moisture and the elements in or on the sand and cores that volatilize at the temperature of molten iron. In the practice of molding, natural or artificial porosity of the sand must be ample to carry off all the gas that is formed. Failure to provide in the mold or cores for free escape of the gases generated by the heat, results in the gas trying to force its way through the molten iron and consequently, formation ofthe inevitable blowhole. Intelligent application of this one first great principle, get off the vent will remedy 95 per cent of these defects.

This is the easier form of the two defects mentioned to correct. The real porosity, spongy spot, openness of grain, or the jagged crystalline cavities that appear, are the real will o' the wisp of the foundry. This defect may be due to a number of reasons and they often are so obscure that it is difficult to arrive at the solution. As every foundryman knows the junction of two or more sections of metal in a casting, causes a spot where the iron remains soft longer than the remainder. When the lighter sections begin to cool the inevitable law of shrinkage draws the already solidified metal from the soft spot thus forming a cavity or porosity or openness in proportion to the severity of the draw.

This is more marked if the sections are of unequal thickness. A number of remedies are available. The castings may have been poured in such a way that the gates conveyed the iron direct to the heaviest spot, giving it the disadvantage of the hottest iron in the heaviest section. A change in the location of the pouring gates sometimes cures the ill. The defect may be located in a place where the manner of pouring has no influence upon it and where the structure of the casting causes it to hold its heat longest, for example, in the center of a casting surrounded with cores. Here it may be necessary to resort to the practice of placing chills in the molds or cores in a position to cool the heavy sections down to a state of solidification approximately as quickly as the lighter sections and thus prevent a draw. The iron mixture may be the responsible factor. Some brands of pig iron possess this shrinkage quality to a greater degree than others, even though the chemical analysis shows they are all that is required. This is one place where chemical analysis is not a complete guide.

In some cases a correction may be accomplished by the addition of a small percentage of steel scrap, in others it may be necessary to make a radical change in the brand of pig iron used. Charcoal iron shows the greatest freedom from this complaint.

Temperature at which the metal is poured has been found to have an influence on shrinkage and porosity. Experience has taught that the iron must not be poured too cold. Sluggish iron gives the worst results. Good hot iron is the best. Many cases of porosity have been entirely cured by pouring with hot iron. The section of the casting rarely can be changed in design to suit the founder, but it is often possible to blend the

junction of two different sections with prolonged or flattened out fillets that taper down to the heavy spot and distribute the draw or pull so it does not cause a porous place. Porous spots often are found that do not yield to any of the foregoing treatments. Sometimes they appear in a casting in which there is no varying section or junction of sections, therefore they always cannot be attributed to the draw of shrinkage. This feature may be noted for example in a straight cylinder 20 inches long, 6 inches in diameter, ½ inch thick that has to be machined all over and stand pressure. The logical and accepted way to pour it is standing on end, the logical way to gate it is on top, and yet this casting may develop porous spots that will leak. Upon examination under the glass, cavities of the crystalline form will show but they are absolutely free from any dirt or deposit.

Here is an example of porosity where varying sections is not the cause. The first iron entering the mold does not lie quietly, but boils and flutters, forming the little spongy masses often noticed in open sand molds where the iron strikes a wet or hard spot or those which collect upon the surface of metal that has boiled in a ladle from a damp lining. The boiling action in the mold occurs before there is much pressure in the mold. By the time the mold is filled and the pressure increased, the gas has been forced through the legitimate channels in the pores of the sand and no evidence of the blow or boil is apparent. The spongy spots may be found in almost any part of the casting.

The first great fundamental in the production of a casting is to prepare a mold and core against which iron in its melted state will lay like oil on a polished surface, without flutter or agitation. The gases of the mold and cores must pass off freely through proper channels. A perfect casting cannot be produced in a mold where the iron does not lie still, not only when the mold is filled and the ultimate pressure is attained, but when the iron first is introduced and the pressure is at its lowest point. Any disturbance results in holes or porosity.

Dissect Properties of Chinese Casting

FRANK A. FOSTER, author of the series of articles on the art of founding in China that recently were published in THE FOUNDRY, sent a piece of a large diameter, Chinese pot to the editors as an example of the extreme thinness of the casting. A chemical and microscopic examination of the cast iron was sought to explain some of the apparent paradoxes of this casting. Clyde Burgston, assistant chief chemist, Deere & Co., Moline, Ill., and J. W. Bolton, metallurgist, Frank Foundries Corp., Moline, Ill., made this investigation. The data noted are as follows:

The section of the casting runs from 0.025 to 0.04 inches in thickness. The fracture is mostly gray although in certain parts it is white. In the gray portions the brinell hardness is 170 and goes as high as 435 in the chilled portions. The chemical analysis is found to be:

	Per cent
Silicon	2.35
Sulphur	0.075
Phosphorus	0.25
Manganese	0.53
Combined Carbon	0.50
Total Carbon	3.70

This analysis approaches the eutectic composition which is the alloy that possesses the lowest melting point. In pure iron and carbon alloys this composition would contain 4.3 per cent carbon, but the presence of silicon lowers the amount of carbon required to form the eutectic. The basis generally used to allocate the silicon, is to allow 0.3 per cent of carbon for each per cent of silicon in the alloy. On this premise the eutectic of this particular casting is, 2.35 x 0.3 subtracted from 4.3 per cent, or 3.6 per cent carbon. This is particularly significant because this thin casting requires the lowest obtainable freezing point that may be obtained.

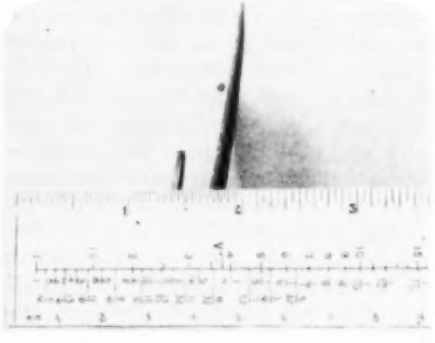


Fig. 1—Large diameter cooking pots have thin walls. This photograph shows a piece of casting compared to a United States 10 cent piece. The metal gives no evidence of being chilled

The metallographic features also are unique, and upon polishing or rubbing the entire surface of the piece of casting with emery cloth, a splendid example of the polygonal or net work formation of the crystalline grain structure of cast iron is revealed. Fig. 2 which shows this structure perfectly, is natural size and is not etched. The large grain size is indicative of slow cooling. Upon microscopic examination of the specimen, the graphite is found to be in

(*Concluded on Page* 358)

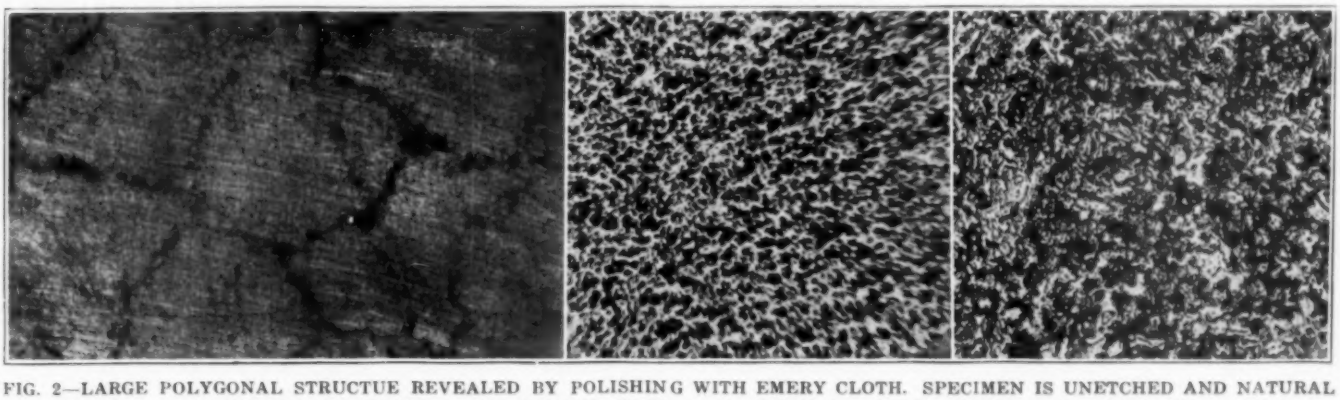


FIG. 2—LARGE POLYGONAL STRUCTUE REVEALED BY POLISHING WITH EMERY CLOTH. SPECIMEN IS UNETCHED AND NATURAL SIZE. FIG. 3—UNIFORMLY DISTRIBUTED AND FINELY DIVIDED GRAPHITE IS SHOWN UNDER A MAGNIFICATION OF 50 DIAMETERS. FIG. 4—HIGHER MAGNIFICATION AT 200 DIAMETERS AND ETCHING WITH SODIUM PICRATE SHOWS SORBITIC STRUCTURE

Can Used Sand Be Reclaimed-V

Mechanical Sand Handling Equipment Introduced Into the Foundry Extensively in Recent Years Has Added an Impetus To Reclamation and Conservation

By Pat Dwyer

INTERESTING details showing the trend of shop practice are disclosed under several headings in the questionnaire analyzed in the second article of the present series, published in the March 15 issue of THE FOUNDRY. Out of 30 foundries only eight report that the sand is cut by hand exclusively. Both machine and hand methods are employed in eight shops and all the sand is prepared by some form of mechanical device in the remaining 14 foundries. In some instances this means that the sand is cut over on the floor. In others it means that all the sand is put through a reviving and blending aparatus several times a day and delivered to the various molding stations as required. A third class includes all steel foundries and a few gray iron and malleable foundries in which the only new sand additions are made through the facing sand.

From the foregoing it is apparent that power operated equipment has taken the place of the sand cutter with his shovel in the majority of foundries. Like many other innovations in the foundry industry the displacement of hand labor by mechanical equipment has been due to two main causes, or rather to two divisions of one main cause. Desire or necessity for increased production only could be met successfully by the introduction of power driven machines whereby the worker could produce on a greatly enlarged scale. To secure maximum production from a large number of unskilled men, the logical and in fact obligatory course was to divide and sub-divide the work into a great many elemental units and then provide mechanical equipment to carry the greater part of the burden and act as a kind of glorified seven league boots for each workman.

Sand Spread Over Heaps

The bonding element is destroyed in the sand which comes into contact with the molten metal, a certain amount of sand adheres to the casting and an additional amount is carried away in the form of fine dust. Clearly a constant addition of new material is required to keep the sand in workable condition and to maintain the volume necessary to carry on the day's work. Local conditions decide the method which is most convenient to use in rejuvenating the sand. Where facing sand is applied to every pattern, the amount of new sand entering the heaps every day through that channel may be sufficient. Where no facing is used some other method must be employed. In large foundries of the continuous type the entire volume of sand is passed through some form of mechanical mixing and reconditioning device several times a day. All the sand is made to conform to a certain definite standard and serves for both facing and backing sand.

In many foundries particularly in small shops, and in shops devoted to the production of stoveplate and light castings in iron and other metals, and in general nearly all shops where the sand is cut over on the floor, a certain amount of new sand is sprinkled over the heaps at periodic intervals, usually every night. In a few instances the amount has been determined after a proper investigation, but in the majority of foundries new sand is added to the heaps in a hit or miss manner. In some instances the amount to be added is left to the discretion of the man on the floor and naturally he sees no necessity for skimping. Old experienced molders prefer sand from which all the organic material has been burned, but which still retains sufficient bond to hold together and resist the heat and erosive effect of the molten metal. Unfortunately, these men are in a decided minority. The average molder likes plenty of new sand. The fact that it is responsible in large measure for cuts, blows and scabs means nothing to him. His interests ceases when he places the cope on the drag and there is no denying the fact that new sand facilitates the making of a mold.

A flat rule is in force in some foundries to add a wheelbarrow load of new sand to each heap either every night or on alternate nights. Usually this amount is in excess of actual requirement and as a result the heap soon assumes unwieldy proportions. The obvious remedy of course would be to cut down on the amount of new sand added from day to day. In some cases this is done. However, the problem usually is attacked from the opposite end. When the heap becomes too large it is reduced by carting the surplus out to the dump or by scattering it over the floor. Instances are not unknown where the floor of a foundry has grown a foot or more in depth in the course of a year. Either method represents a waste of perfectly good sand.

Approximately 25 per cent of the foundries reporting indicated that both dry and green sand molds were made in the one shop. The proportion of dry sand molds to green in any one foundry ranged from 5 to 70 per cent. The remaining foundries operated exclusively on green sand and included shops engaged in the production of nearly all classes of castings in ferrous and nonferrous metals. In this connection it is interesting to note the extent to which steel foundries have adopted green sand practice in recent years. The character and weight of the individual castings exert an important influence in the choice between green and dry sand, but a pertinent illustration of the general trend is supplied by the three examples listed on the table referred to previously.

One company melted 6000 tons of steel per year and made 70 per cent of the molds in green sand. The remaining 30 per cent of the molds were made in dry sand or in combinations made up largely of dry sand cores. A second steel company melted 45,000 tons of metal and made 85 per cent of the castings in green sand molds. The third foundry is the largest of the three with a total melt of 60,000 tons and curiously enough the percentage of green sand molds is the largest, 90 per cent.

Nearly All Green Sand

Further indication of the extent to which the old order is changing is found in the column showing the relative number of foundries in which the sand is prepared at night as compared with the number in which the sand still is prepared and used by day. Out of 30 shops selected for comparison 13 report that the sand is cut over by day and 17 report that this part of the work is done by night.

Mechanical equipment is employed both day and night in the preparation of the sand in all these foundries with the exception of three where the sand still is cut over by shovels. One of these is a small nonferrous foundry melting 100 or 200 pounds per day.

The remaining two are general jobbing gray iron foundries running average daily heats of 10 tons where the individual molders cut over their own sand.

Data presented in the last two columns of the table are rather inconclusive. They show that five foundries out of 30 have tried experimenting with clay as a substitute for new sand. Out of this number two abandoned the experiment while two succeeded to such an extent that they no longer buy new sand. The fifth is a steel foundry where clay additions always have been made to the sand, therefore it has no proper place in the list.

Another important point, and this applies to practically all statistical deductions based upon a partial survey, is that the percentage of foundries all over the country converted from sand to clay is not so large as one might infer from the table. The leaven is spreading and the men who supply the clay confidently predict a capacity demand in a short time. Two out of 30 is 6.6 per cent and the same percentage of the total number of the foundries in North America, approximately 7000, is 462. At present the actual converts to clay number less than 100 but their work is being watched closely by a large number of interested foundrymen both in the immediate neighborhood and elsewhere.

Tests Sand Regularly

Among the 30 reports selected from the total number of questionnaire forms returned only three show that any attempt is made to observe close control over the sand in a scientific manner and not a single one of these reports is from a gray iron foundry. One is steel and two are malleable and one of the malleable foundries uses clay instead of new sand to rejuvenate its supply of molding material. As stated previously, this foundation scarcely is sufficient on which to build any kind of a plausible theory. Instances of sand control methods and the plants where they are practiced instantly come to the mind of any person familiar with the foundry industry and its literature. The fact that the published list did not happen to include one or more, in the nonferrous and gray iron fields is unfortunate, but it does not prove that sand control methods are not practiced to a considerable extent.

All the large corporations with foundry plants in various cities and towns maintain laboratories and research departments and many individual foundries are equipped in a similar manner. Duties of the men connected with these departments cover a wide range and include periodical testing of the sand used for molds and cores. Special tests are run when a variation in the product or any other untoward condition indicates that an examination is required. Usually, the results obtained from the three forms of test sanctioned or adopted as standrad by the American Foundrymen's association, moisture, permeability and bond strength, are sufficient to correct any slight irregularity and restore regular routine conditions. some of the conclusions in a report recently prepared by the research staff of a radiator corporation are particularly appropriate at this time and are presented here as a typical illustration of the interest taken by large foundry organizations in the subject of sand reclamation and conservation. A portion of this report is as follows:

****A fine sand from a sieve analysis point of view has been considered essential in the past to produce a smooth radiator or plate casting. Recent research and investigation indicate that it is not the presence of coarse material, grains stopped on the 35, 65 or 100-mesh sieve, that determines the smoothness of a casting. The amount of exceedingly fine material or grains that pass a 300-mesh sieve, the amount and nature of the bond, the percentage of moisture and the preparation of the sand before it enters the mold, are the factors that affect the appearance of the surface of the casting.

Briefly, all molding sands are more or less perfect mechanical mixtures of grains of various sizes and shapes and amount of bond, the latter element composed of chemical colloidal clay and hydroxides. With a thorough understanding of the characteristics of each of these ingredients and their collective influence upon a molding sand, it is apparent that a new field has been opened in the preparation of molding sands suitable for radiator and boiler castings. Great economy may be effected by the intelligent employment of what today is considered waste sand. In the not distant future the foundryman will no more think of throwing a car of old sand over the dump, than he will think of throwing away a car of iron because it is not listed as *A No.* 1 fresh from the blast furnace.

Requirements of a good radiator or boiler molding sand follow:

The sand should be sufficiently permeable to permit the ready escape of the air in the mold, also the steam and gas generated when the mold is filled with iron. Permeability is dependent upon the texture of the sand, the percentage of clay, carbon and organic substance. The moisture content and the density to which the sand is rammed also must be taken into account. Lack of proper balance between the foregoing factors will cause cuts, scabs, chills and blowholes in the castings.

Sand should possess sufficient bond to prevent drops, washes and cuts and since cohesiveness depends to a great extent upon the moisture content, the tempering of the sand should be attended to with the greatest care. Low or high bond sands, also wet or dry sands frequently are condemned as inferior when as a matter of fact they prove quite satisfactory when rammed properly to a suitable density. To avoid confusion and secure the best possible results it is desirable to provide a sand in which the bond and temper is as nearly uniform as possible from day to day.

Partial destruction of the bond through contact with the iron in the molten state and later when the sand is allowed to remain in contact with the casting while it is setting and cooling is effected through dehydration of the clay part of the sand and will vary according to the thickness of the casting, period of time the casting remains in contact with the sand and upon the amount and nature of the bond. Further, the loss will be gradual, that is the sand nearest the iron will lose most.

To prevent deterioration in the sand heaps, an amount of bond equal to that destroyed must be supplied daily either through the addition of a heavily bonded new sand to the heaps directly or through special prepared high bond facing sand. The tendency recently is to eliminate facing sand wherever possible. Therefore the only course left to maintain the heaps in workable condition is to add the bonding material directly to the heaps.

The quantity of extremely fine grains present in the molding sand is the principal factor governing the permeability of the sand and the smoothness or surface condition of the casting. Based on this characteristic, relatively coarse sands may serve as a base in the preparation of synthetic or blended molding sand. Subsequent consequent control of permeability and bond may be secured through varying additions of fine molding sand or clay.* * *

Large Quantities

Immense volume of sand required at the various plants of this corporation converts the problem of reclamation and conservation into one of the first magnitude. The prospect of saving a few dollars here or there by skimping and the exercise of more than usual vigilance is not particularly alluring to the average person. When the possible saving runs into five figures the subject is worthy of and invariably commands the close attention of those whose duty it is to see that the corporation does not pass a dividend.

In this particular instance the yearly consumption of new sand used for boiler castings amounted to 23,000 tons. In the radiator departments the amount totaled 64,000 tons. As a result of a policy adopted last year, a policy based on the premises set forth in the excerpt quoted, the amount of new sand required has been reduced materially. The amount re-

quired for the current year is estimated at 6900 tons for boilers and 26,000 tons for radiators, or a combined saving of 54,000 tons. The cost of sand delivered varies to some extent depending on the location of the different plants, but even on an estimated flat minimum average of $2.00 a ton the saving amounts to over $100,000.

Up to the present no serious effort has been made to economize on the use of core sand notwithstanding the fact that the yearly consumption is 164,000 tons, practically twice the amount of new molding sand used in the same plants. This is due to several reasons. The first and probably most important reason is that foundry superintendents do not look with favor on experiments in the core room. Cores used in radiator and boiler shops must approximate ideal conditions more nearly than those employed in any other class of castings and the majority of defective castings in these plants may be traced to cores that did not measure up to the practically perfect standard in every respect.

The second reason is that core sand is available in the vicinity of the various plants, handling and freight costs are comparatively low and therefore the margin susceptible to saving is not so attractive as that presented by molding sand.

Data secured from an extended series of experiments indicate that used core sand may be reclaimed at an estimated cost of 70 cents a ton, but whether the margin between this and the price of new sand is sufficient to warrant the installation of extensive and somewhat elaborate equipment, still is debatable. Information on this point is not available for publication.

Elaborate Equipment

Methods and equipment proposed for the work are the same as those tried by H. M. Lane several years ago under the auspices of the Detroit Foundrymen's association and include a kiln for burning off the carbon coating on the grains, tumbling mills and screens for pulverizing the lumps and separating the various size grains and subsequent air flotation or washing to remove the dust or silt deposit. Although Mr. Lane demonstrated that old sand could be reclaimed on a profitable basis, the margin of profit was so narrow that foundrymen were not encouraged to install the necessary equipment. The cost of new sand for molds and cores in the Detroit district 12 to 14 years ago was only a minor factor in the total cost of the castings. Conditions are different in other parts of the country. Even in Detroit today the cost of sand is an item of importance and for that reason the conclusions derived from the tests at that time may be of interest now. Briefly they may be described as follows:

Ultimate use of foundry sand depends upon the character of the original sand, the species of binder employed and the general classification of the casting. In steel casting plants good recovery may be had by either the wet or the dry method.

Dry Cleaning

The dry cleaning process requires less plant installation, but more power for operation. However, the cost per ton will be less by the wet process so far as the actual cleaning is concerned, but where the sand is to be used again, drying apparatus is necessary. Cleaned wet sand was found to be fully as good as new sand for making molds for steel castings. For some classes of castings the reclaimed and dried sand was almost as good as new sand.

An entirely different set of condition was encountered in the iron foundry. For large cores made from the usual mixture of coarse sand or gravel, the dry cleaning process removed sufficient fine material to render the remainder satisfactory. A number of gray iron foundries reported excellent results with wet cleaned sands and some have good results from dry cleaned sand, with oil sand cores made from fine sand without any sea coal or coke dust. The dry cleaning process was reported satisfactory for reclaiming sand from cores bonded with pitch base and water soluble binders.

Neither the wet or the dry process removed the carbon deposit from fine sand sufficiently to provide a high binding ratio for oil sand cores. The dry cleaning process returns an excellent product in brass and aluminum foundries where the core sand is bonded with rosin, flour or any of the paste binders. In several plants using fine core sand, all the refuse sand from the cleaning room and gangways was dry cleaned and then bonded with clay to serve as molding sand.

Several prominent eastern plants during the past two years have carried on extensive experimental work with a view of replacing new sand with a clay binder. Naturally it has been a cut and try proposition and a considerable time was required before any tentative method could be standardized. Apparently their efforts have been successful in whole or in part. Out of eight foundries visited recently four are using clay exclusively. In the remaining four foundries clay has replaced new sand as a bonding agent on from 40 to 70 per cent of the floor area.

This is the fifth of a series of six articles by Mr. Dwyer on the general sand situation in the foundry. The sixth which will appear in an early issue will contain description of equipment and methods for reclaiming sand by the addition of clay.

The Editors.

Dissect Properties of Chinese Castings

(*Concluded from Page* 355)

a finely divided state and uniformly distributed. This condition clearly is visible in Fig. 3. This micrograph is magnified 50 diameters and shows the graphite to be in spheroidal form, but not much significance can be placed on this feature because the form may be altered somewhat during the polishing of the specimen.

When the magnification is increased to 200 diameters and etched with Kourbatoff's reagent, alkaline sodium picrate, to aid in distinguishing the various components in the structure, a cellular eutectic conformation is observed. Close examination failed to show the characteristic lamellar structure of pearlite and the conclusion drawn is that the matrix is largely sorbite or an almost structureless pearlite referred to as sorbitic pearlite which is formed sometimes at moderately rapid rates of cooling. This peculiar formation is seen in Fig. 4.

This apparent paradox of fast and slow cooling wherein a large grain size and sorbitic structure are obtained may be explained by the thinness of the section which cooled rapidly, above the pearlitic transformation point after striking the mold surface. The mold surface then became heated and the cooling rate was then slow enough to allow the growth of large grains. Experiments have shown in the case of castings observed that the rate of cooling to 1600 degrees Fahr., was rapid while from 1600 to 1300 degrees the rate was slow, taking several hours.

Foundrymen Meet in East

New England Foundrymen's association held its regular monthly dinner and meeting at the Exchange club, Boston, on April 14. Ralph Meigs, General Electric Co., West Lynn, Mass., spoke on the impressions of an apprentice. L. A. Hartley, National Founders association, gave a talk on organizing an apprentice training program for the foundry.

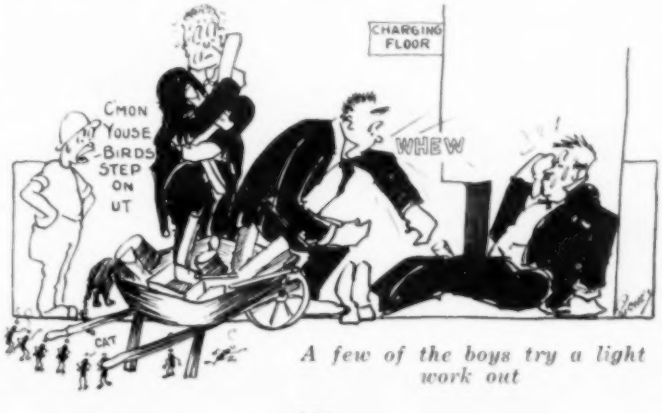
Bill Talks on Hermits Hoboes and Brake Shoes

By Pat Dwyer

UNDER ordinary circumstances I have little desire to live the life of a hermit. I have read many stories of men who live in this manner for years and invariably I have decided that they were the victims of some species of hallucination. This opinion was confirmed by an old cupola tender whom I knew personally and who lived by himself in a little shack he had built on the edge of the town at the farthest possible point from the foundry where he was employed. To a certain extent I could understand why he preferred to live his life in his own way without assuming the cares and responsibilities as the supporter or head of a family, but with all kinds and conditions of boarding houses in the vicinity of the plant, I could not conceive why he preferred to walk a couple of miles to and from his work night and morning.

He certainly did not need the exercise. So far as my experience goes cupola tending never has been classed as a minor sport. Even under the most favorable circumstances where the men are provided with all kinds of mechanical equipment, there is enough manual labor involved to enable the men to preserve a beautiful straight front. In a small shop where a single man clears away the bottom, picks and daubs the lining, puts up the doors, rams the bottom, splits kindling wood, breaks scrap and pig iron, wheels a ton of coke and 4 or 5 tons of iron from the stock pile to the charging platform and charges the material into the cupola, he has no time to pick daisies by the wayside. By the time he has daubed a few ladles, tapped the heat and dropped the bottom he usually is willing to admit that he has earned his stipend. He is more than willing to call it a day and knock off. When I read of these gentlemen who pay a gymnasium instructor fancy fees for putting them through a course of setting up exercises I sometimes wonder why they do not keep their money in their pockets and apply to some foundryman for a couple of hours work on the charging deck. I am sure he would be glad to oblige them and charge them nothing for the privilege. Most assuredly they would have more muscles brought into play in a single session than they would have in a gymnasium in a week. At a conservative estimate I am inclined to the opinion that the exercise of pitching iron and coke into a roaring cupola in an effort to keep it filled to the door for an hour or two would sweat more poison out of their systems and more fat from their belt lines than a thousand miles of golf.

The idea seems to have possibilities and perhaps sometime when I have more leisure I shall make a study of the subject. In the meantime if any enterprising young citizen wants to develop a process and cash in on the proposition before the field becomes over crowded, he has my permission to start a publicity campaign immediately. The preliminary work probably will include the designing of a suitable costume, a score card on which to mark the tonnage handled, drawing up of by-laws and constitution and the adoption of a good snappy slogan.



A few of the boys try a light work out

This last item presents a serious problem since practically all the worth while slogans already have seen service. "Charge it" has a mercantile flavor. "Charge Chester, Charge!" might serve if it were not for the fact that the heirs of the late Walter Scott probably would file suit for damages under the provision of the international copyright law. The same objection holds with many stirring lines that otherwise might be appropriated from the late Mr. Tennyson's *Charge of the Light Brigade*.

However, this digression is leading too far afield. While I realize that fame and fortune await the man who starts the movement I am not sufficiently ambitious to attempt it. Even the prospect of having my name go down to posterity in company with such sterling benefactors of the human race as Mr. Carter, not Nick, but his little liver pill brother; Doc. Munion, Lydia Pinkham and the two Smith brothers, Trade and Mark, will not induce me to start the campaign.

Now let us return to the hermit. As I said in the beginning, I have no desire to live the life of a hermit, but all general rules have exceptions. Under certain circumstances the lonely life seems to present compensating features. This view was brought home to me forcibly during the past week when our usually peaceful little cot was turned upside down and inside out in the throes of the spring housecleaning.

On several occasions I visited the residence of this hermit to whom I referred previously and always found everything in its accustomed place. Mentally I called up a picture of this quiet, peaceful little place recently and contrasted it with the wreck which I call home. Instead of the orderly arrangement to which I had become accustomed since the previous upheaval, the house looked as if it had been visited by a tornado, a fire and a tidal wave. After the

painters and paper hangers disappeared, the furniture had to be redistributed, and I discovered that I had been elected to the position of chief distributor.

If I can persuade a few other downtrodden worms to join me I will present a petition to Mr. Hoover in the near future to appoint a committee to standardize the position of furniture in the home. On second thought perhaps this subject more properly might be brought to the attention of the American Foundrymen's association pattern standardization committee. It is readily apparent that if each piece of furniture were provided with a few suitable dowel pins and if corresponding dowel holes were bored in the floor, the work of distributing the furniture would be facilitated to a gratifying extent. The present system is in a hopeless state of confusion. The only rule that seems to prevail is that under no circumstance is any piece of furniture allowed to occupy the position on which it reposed previously.

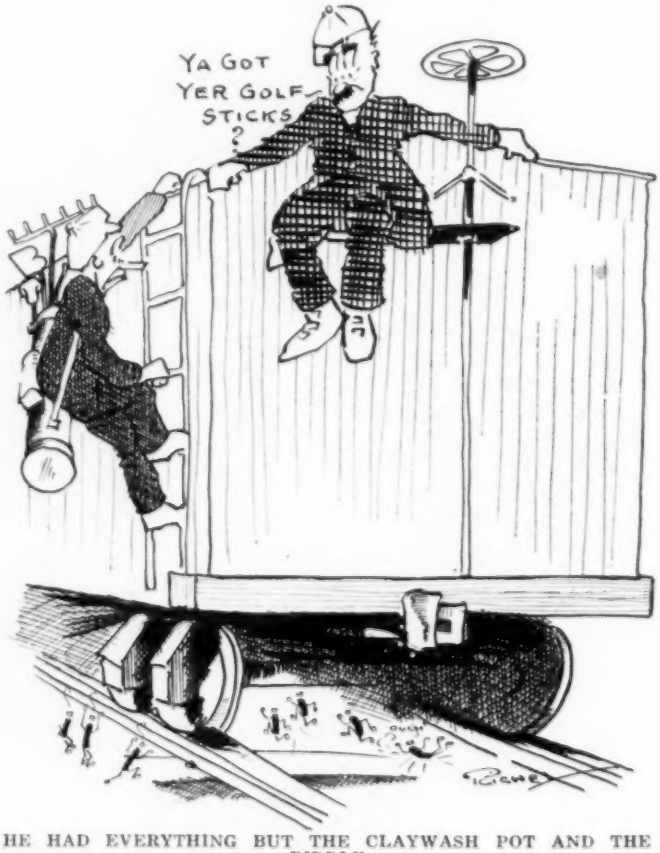
Bill came in the other night to spend a quiet hour and was surprised to find that his favorite chair had been shifted from the north to the south side of the room. He sprawled his long feet out in front and then threw an appraising glance from side to side. Answering his unspoken question I modestly admitted that I had shifted the stuff around just as an outlet for superfluous energy.

I am afraid he did not believe me. He made no verbal comment, but he closed one eye in a highly insulting manner and arched his other eye brow interrogatively while glancing in the direction of the lady who was perusing the evening paper in a third chair. This lady is peculiarly gifted in that she can read a paper and at the same time hear every word spoken in the vicinity, or hear nothing at all just as she pleases. In this instance she did not lift her eyes from the paper, but she shrugged a shapely and eloquent shoulder and I realized that my statement was a total wreck, lost with all hands.

Although I realized I was treading on dangerous ground I introduced the subject of hermits with particular reference to the peace and comfort they enjoyed outside the hurly-burly of modern domestic life with its periodic upheavals in the spring and fall. I hastened to add that I did not envy them and certainly had no intention of emulating their example. My interest in the subject was purely academic.

"Well," said Bill, "I'll tell you. These here now hermit guys may be all right, but the way I dope it out their bells don't ring, they haven't got all their marbles. Kinda nutty if you get what I mean. Personally, I can't see how a bird can live by himself for years. I can easily understand how a young lad can dodge responsibility and keep moving from place to place for many years, but this idea of anchoring down alone in one place for the natural duration of a man's life is over my head. If one of these ginks had any sense and still hankered for the lonely life he would bat some innocent citizen over the head and have himself sent for life to a quiet place where he need not bother about board, room or clothing.

"My knowledge of hermits is confined to an exceedingly hazy recollection of my school days about *Peter the Hermit* who conducted a crusade of children to the Holy Land. He must have found the hermit business pretty monotonous or he never would have started off on such a wild goose chase. He may have been a hermit when he started, but I bet you before he was through he could qualify as a member in good standing of the Grand Lodge or of any subordinate branch of the Ancient, Free and Independent Never-Say-Work Hoboes of the World.



HE HAD EVERYTHING BUT THE CLAYWASH POT AND THE RIDDLE

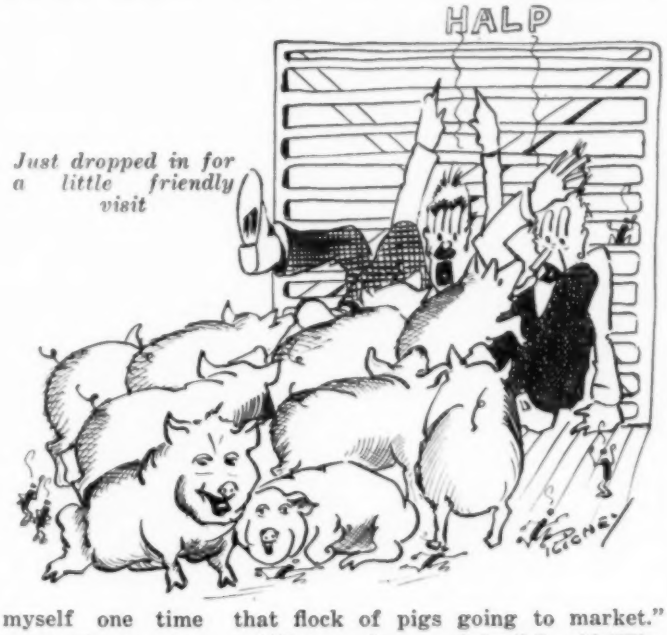
"I don't think I ever told you of a peculiar experience I had at one time many years ago when I was a member in this august organization. Another lad and I had finished a brief engagement in Toledo. We might have stayed longer, but an unfeeling gaffer without the formality of consulting our wishes had removed our names from the payroll. We carefully weighed the merits of all the towns within a reasonable cruising radius and decided that Cleveland was most deserving of our patronage. This decision was influenced to some extent by the fact that a preliminary scout around the railroad yard discovered a freight pulling out in that direction.

"The night was dark and cold as all billyhell and we were subjected to the greatest risk and inconvenience in climbing to the top of a box car. These soulless railroad companies betray the most callous indifference to the comfort of their passengers. Absolutely criminal negligence I call it. I was traveling light with nothing but a trowel and a double ender in my inside pocket, but my partner was young and inexperienced and insisted on dragging around a bag filled with more tools than can be found in the ordinary hock shop window.

"In addition to a mess of small finishing tools he had a swab, a blow can, a rapping bar, a hammer and one of these trick rammers that screw apart in the center. The bag was almost as long as a golf bag and even at that one of the lifters stuck out so far that I often wondered he did not tie a red handkerchief or hang a red lantern on the end to prevent a truck from running him down. We were reduced practically to the condition of a pair of frozen herring when a brakeman discovered us as the train was creeping into Sandusky. Instead of attempting to kick us off the roof of the car this good Samaritan expressed the deepest sympathy.

"'Youse guys' says he 'Aint got no sense. Why don't youse go inside the car where you will be warm and sheltered from all the elements?"

"We admitted feebly that the idea had occurred to us, but the door was locked when we had tried it in Toledo. We had boarded the train somewhat in a hurry and fully anticipated making suitable arrangements with the porter or the conductor enroute. Unfortunately neither of these gentlemen had put in appearance and as you might say, here we were. As a result of this experience the Lake Shore & Michigan Southern railroad had dropped considerably in our estimation and in future we proposed to patronize other lines that made some pretense to catering to their passengers comfort. 'If I did my duty' said the lad with the lantern 'you could commence right now but I was a molder myself one time before I had sense enough to quit. For the sake of old times I'll smuggle youse into the car, but its up to yourselves to make a getaway in Cleveland.'



Just dropped in for a little friendly visit

"He showed us a little opening in the end of the car through which we could drop to the inside. I lowered myself through the opening and landed on something soft and yielding that jumped from beneath me with a most unearthly screech. I fell against the end of the car scared stiff and before I could collect enough breath to shout a warning my partner with his bag of junk came tumbling down on top of me.

"For a few minutes I confess I harbored the most cruel and unjust suspicions against the good natured brakeman. Instead of pushing our frozen bodies off the roof of the car to be splintered into fragments on the hard road bed, he had introduced us to a den of wild beasts where we would disappear automatically without benefit of clergy, bell, book or candle.

"Before I could regain my feet about a million animals ran all over me, every one apparently as big as an elephant. Finally I scrooged myself into a corner and struck a match and I hope to die if we were not cooped up with—now what do you think—a car load of pigs!

"My partner fished his hammer out of the bag and I armed myself with the rammer and thus fortified we belted the animals away from our end of the car and rested in peace to the end of the journey. At one time or another I have traveled with all kinds of company and in all kinds of conveyances, but I never had such a fright as I suffered in the first few minutes after I landed among that flock of pigs going to market."

"If you ask my opinion" I said "The experience served you right. Why did you not pay your fare like a Christian and travel in comfort?"

"Pay a fare?" Bill ejaculated in a horrified tone. "Don't you know that self preservation is the first law of nature? If I had wasted my money paying railroad fares I would have had to go hungry and what was even more important in the old days, I would have had to go dry. What with vicious dogs and hard faced women a man could not depend on a hand out with any degree of regularity and every bar tender kept a bung starter handy for the benefit of thirsty gentlemen who attempted to slip out unobserved without paying for a few of the tall ones."

"Since you are here" I said "I naturally assume that you eventually escaped from the pig pen. After such a harrowing experience I hope you landed a good job to kind of even up the score."

"No" said Bill "We did not. We tried the Walker Works, the Otis Steel and Kilby's, but they were filled up and we finally had to take a side floor job in a shop down on the flats. I got a couple of brakeshoe patterns, but the castings were so rotten I quit after a couple of days. The patterns were drafted to mold face up and a steel reinforcing plate was placed in each drag. Invariably the face of the casting was filled with blowholes and the gaffer did not know whether to blame the core, the rusty plates, hasty pouring or me. Following the line of least resistance he decided I was the goat so I butted him one or two to remember me by and quit.

"Since that time I have learned that brakeshoe makers realizing the danger from rusty plates, eye cores and hasty pouring unanimously have adopted the practice of molding the working face of tne shoe in the drag. All reasonable precautiions are observed to prevent the metal from blowing, but if a few bubbles appear on the back of the shoe they do not spoil the casting.

"Plates should not be allowed to rust. They should be stored in a dry place and should be dipped in a preserving bath of tar or oil immediately after they leave the stamping press and while they are clean and free from scale. The core should be made from a free venting sand mixture that will allow the iron to lie against it quietly. While it is true that slow pouring will permit a considerable volume of gas to escape before the mold is filled, still it is better practice to adopt measures that will prevent the formation of gas. The average man pouring iron only has one thought in mind and that is to empty his ladle as rapidly as possible.

"He is willing to do his best, but misunderstandings will creep in as in the case of Bridget when her mistress told her she was expecting a few friends to spend a musical evening. 'Now Bridget' said she 'I rely on you to do your best.' 'Faith, ma'am' Bridget simpered coyly, 'I ain't sung a note for years, but I won't see you stuck. You can put me down for *It Ain't Gonna Rain No More!*"

Associations Held Joint Meeting

Newark Foundrymen's association and the Employers association of North Jersey held a joint meeting at the Downtown club, Newark, on April 20. L. A. Hartley, director of educational training, National Founders association, spoke on organizing a foundry apprentice training program.

Manley Sand Co., 527 Roosevelt road, Chicago, has been formed to handle sales in Chicago for the Rockton Molding Sand Co., Rockton, Ill. L. T. Manley is head of the firm.

Adopt Principles for Apprentice Training

THE New England Foundrymen's association, at a recent meeting, approved a report of the committee on foundry training covering principles for cooperative apprenticeship training. The members of the committee are as follows: Chairman, L. S. Harding, Worthington Pump & Machinery Corp., Cambridge, Mass.; E. H. Ballard, General Electric Co., Lynn, Mass.; H. S. Chafee, Builders Iron Foundry, Providence, R. I.; T. R. Scott, Brown & Sharpe Mfg. Co., Providence, R. I. and R. E. Newcomb, Worthington Pump & Machinery Corp., Holyoke, Mass. The principles adopted by the association are as follows:

Definition of Apprenticeship

An apprenticeship is that formal relation between employer and employe through which the mutual obligations of each are established by written agreement.

Its aims are twofold.

It assures to the apprentice the opportunity of training and developing his hand, mind and heart, manually, mentally and morally, in such a way that it increases his economic efficiency as an individual, makes him a better workman, a better citizen, and a better man.

It assures the industry to just that degree to which its employment is general, an adequate supply of trained, intelligent, capable and loyal artisans.

The Agreement

There may be a difference of opinion as to the value of the written agreement, but it is thought such an agreement lends dignity to the relationship, and its moral effect justifies the continued use of the formal indenture. This agreement should not be entered into until after a suitable probationary period, as discussed later. After such a period a formal agreement should be executed, the parties to this agreement being the employer or a qualified representative, the apprentice, and his parent or guardian, should he be a minor. This instrument should be considered by all parties as a mutual promise of performance and of good faith, rather than merely as a binding contract. It is recommended that there should be no prosecution should the apprentice violate its provisions as an unwilling apprentice cannot be considered an asset. The agreement should set forth a definite maximum and minimum period of apprenticeship and a fixed minimum compensation to be paid by the employer to the apprentice with the raises which shall be effective and the definite time at which such raises shall be effective. The agreement should provide for honorable termination by either parties for justifiable cause.

Eligibility

To be eligible for apprentice training, applicants

1. Should be not less than sixteen years of age.
2. Should have received the education implied by graduation from grammar school or its equivalent. In the absence of such qualification, a simple written or oral examination may be given to determine the applicant's ability to understand, read and write simple English, and to perform with simple figures.
3. Should possess a sufficient degree of physical development to fit him for the trade. A physical examination by a regular industrial physician may be required to determine this fact, or in the event that such an agency is not securable, the services of the industrial clinic of the Massachusetts general hospital and of the life extension.
4. Home conditions should be investigated with a view to determining if the parents or guardian are thoroughly in favor of their boy's ambition to learn a foundry trade. It is recommended that the parents or guardian be interviewed as this step has been proven as a beneficial influence.

Probationary Period

Before an agreement is executed, the applicant having satisfied the foregoing requirements should be required to serve a probationary period of three months, so that a well-grounded opinion may be formed of the aptitude of the applicant in the work of the trade and his liking for it.

Period of Service

The basic term of apprenticeship should be substantially four years, divided into eight periods of approximately 1200 hours each. In the case of apprentices having a high school education or its equivalent, the period may be shortened to three years or six periods of 1200 hours each. Graduates of technical colleges may qualify for a shortened course of two years or four periods of 1200 hours. It is suggested that the above be used as a basis for granting credit for prevocational preparation. All time lost in a period except that of an annual vacation of one week must be made up in that period, before starting on the work scheduled for the next period.

Supervision

The responsibility for apprentice training should be definitely placed in the hands of some one individual. Even in the smaller shops some one should be responsible for this as a part of his regular work, and where the problem is large enough, an apprentice supervisor may be employed on part or full time. The production foreman, because of other responsibilities, seldom has either the time or the patience required for the instruction of learners. The committee on foundry training of the New England Foundrymen's association generally is able to recommend capable men for this work either for part or full time assignments.

Minimum Trade Training

Schedules of work somewhat different in detail but based on the fundamental that apprenticeship presupposes an opportunity for all-round foundry training should be developed to fit the needs and opportunities of the individual foundry. The time distribution usually adjusted with the ability of the apprentice and the production conditions in the foundry.

Correlative Class Work

There is a certain amount of technical information that is essentially a part of the equipment of a skilled foundryman as is his knowledge of and ability to perform the manual work of the trade. Apprenticeship should be organized so that the acquiring of this information will be as well provided for as is perfection in manual operation. Experience seems to indicate that five hours a week spent in the class room in organized study and in approved courses is ample for this purpose; it is suggested that such time be provided as an integral part of the apprenticeship program and that it be paid for at the regular rates of pay. Courses which have the approval of this body are now in preparation in co-operation with the Massachusetts department of education. A synopsis of the field that will be covered in the work for the four year group follows. This may be modified somewhat by further study but in substance it is indicative of the direction which this work will take. It is expected that in its final form this will be arranged so that it will be applicable alike to the small foundry with three apprentices and the larger plant able to train twenty apprentices.

Obligations

The committee responsible for this plan believes that it is the duty and obligation of the apprentice employer to provide such opportunity and supervision that the apprentice will develop to his full capacity as a competent craftsman, a good citizen, and an upright man. Apprenticeship presupposes three training obligations upon the part of the employer—the training of the hand, of the mind, and of the heart—manual, mental and moral. To hide behind the skirts of apprenticeship in the expectations of obtaining a supply of cheap labor for the lighter and less important forms of foundry work, should be frowned upon and discouraged by the industry. A scale of wages should be paid which would enable the apprentice to live suitably. A scale based upon experience and general practice is recommended elsewhere in this plan. The committee believes that it is the duty and obligation of the apprentice to serve faithfully and diligently the period of his indenture.

Interchange of Apprentices

In many plants it is impossible to give a complete training course in the foundry trade for apprentices, although such plants may be so equipped that a considerable portion of the trade may be so provided. Under such conditions it is suggested that a transfer or inter-

(*Concluded on Page* 363)

Adopt Principles for Apprentice Training (Concluded)

(*Concluded from Page* 362)

change of apprentices to supply a portion of the necessary training may be arranged. Until such time as other arrangements are made or that this committee is relieved of its function, this committee will be pleased to entertain such proposals, and it is believed that suitable arrangements will be made for transfers as the individual needs arise. No foundry should allow such a possibility to interfere with the establishment of a suitable program.

Forms

Simple, effective forms for use in keeping the records incident to the maintenance of an apprenticeship program have been prepared, copies of which may be secured upon application to this committee together with any personal service or expert advice desired to establish a program within a member shop.

The National Founders Association Certificate

Upon completion of the apprenticeship, all relevant information regarding the apprentice should be forwarded to the National Founders association, and if the approved standard of training has been met, a certificate of apprenticeship signed by the president and by the commissioner will be issued, guaranteeing to the industry that the recipient has completed a course of training meeting a recognized standard.

Employers Diplomas

In addition to this certificate, those who wish to do so may issue a company diploma of its own design, or diplomas with provision for the engraving of the company's name may be secured through this committee.

Four Year Apprenticeship

The schedule of work should be so arranged as to give experience in the following divisions of the trade:

Grammar School Graduates

Helping molding.
Machine molding
Bench molding.
Large cores.
Small cores.
Miscellaneous floor work.
Furnace.
Green sand molding.
Dry sand molding.
Sweep molding.

Casting, checking, sand mixing, sifting, crane work, time study, night work, etc.
Chipping room.

Three Year Apprenticeship

Some credit should be allowed for varying amounts of prevocational training. The basic period, namely the period required of a grammar school graduate to complete the work should be four years, that for a foundry trade school graduate three years, and that for a college graduate two years. The time suggested above is not recommended as a hard and fast rule but rather as a basis on which individual cases may be judged.

Cast Pipe Centrifugally

(*Concluded from Page* 353)

amount of metal for the pipe being cast. Each pouring trolley takes care of six pipe casting machines. They work independently of each other, although either can charge any of the casting machines when necessary.

Temperature Is Controlled

An automatic recording pyrometer takes the temperature of the iron as it flows from the cupola. This record also shows the number of taps made from the cupola and the duration of each tap required to fill the ladle.

In the casting bay the temperature in each ladle of iron is read with an optical pyrometer, and is reduced to a predetermined point before pouring. Test bars 1 x 2 x 28-inch are poured in pairs every 3 hours. These bars are broken in a standard recording transverse testing machine. Drillings are taken from the broken bars and chemical analyses are made covering all essential elements, silicon, sulphur, manganese, phosphorus and total carbon.

Recording pressure gages are maintained on each cupola. A screen test is run on each car load of sand. A viscosity test is made on each car of tar. Recording thermometers are maintained on the pipe cooling ovens, and the socket core ovens. A complete set of modern sand testing instruments are used and one man per shift devotes all his time to the testing of the molding sand. Recording thermometers are maintained on the tar dips and the temperature of this coating material is under automatic control.

An instrument connected to the hydraulic press records the actual pressure applied to each individual pipe as well as the time the pipe remains under pressure. The same type of instrument is used for recording the pressure of air applied to pipe. The scale on which the pipe are weighed has an automatic beam attachment which shows the actual weight of the pipe without any shifting of weights or manipulating of beams.

Standard machine tools are located at station 54 on the first floor where they are served by a 5-ton overhead three motor crane as shown at 55. The floor space between 54 and 55 is used for storage of the spare tools and equipment necessary to maintain and operate the plant.

The runs shown at 57 are used for emergency and temporary purposes for segregation of pipe coming out of the plant before it moves to the loading yard. A reclaiming unit at station 58 handles all the refuse from the plant.

This plant on a 24 hour schedule has a nominal daily capacity of 50,000 feet of pipe with a range of sizes from 4 to 12 inches inclusive. Any two machines in the shop may be devoted to any given size.

Pipe machines and all equipment connected with them are adjustable and interchangeable to the extent that any machine can be adjusted to handle any size pipe from 4 to 12 inches.

Outside and inside pipe surfaces, are clean and smooth, the bead and bell are true to the pattern, and are entirely sound and free from gates and fins. The sections are uniform both circumferentially and longitudinally and the pipe are round and straight. The metal shows a gray iron fracture with a fine, close grain on the outside of the pipe, changing gradually to a normal medium grain on the inside. The microscope shows a fine skin on the outside; there the graphite immediately forms in fine whorls, the size increasing slowly until the inner surface is reached.

Report Progress on Coming Exhibition

Tentative applications for exhibitors' space at the Detroit convention of the American Foundrymen's association indicate that a keen interest is being taken. The space already requested approximates the total used at the Cleveland exhibit in 1923. Reports from Vincent Delport, European representative of the association and also European manager of THE FOUNDRY, predict a good attendance from Great Britain, Germany, France and other foundry centers overseas. It is expected the registered attendance will be at least twice that of Syracuse.

J. C. Woodson, former section engineer in charge of industrial heating, has been appointed manager of the industrial heating engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

How and Why in Brass Founding

By Charles Vickers

Cores Cause Blows

We are having considerable trouble with bronze bushing cores; they are either too hard or too soft. When they are too soft the metal cuts into the core, and when they are too hard the core blows.

A core sand mixture frequently used for bushing cores is the following; sharp sand 14 parts; molding sand 4 parts; flour 1 part. Mix with molasses water. Sometimes the cores are made entirely of sharp sand, bonded one to ten or one to twelve with flour. Oil also makes a fine bonding agent for sand for cores; and the names of manufacturers of core oils will be found by consulting the advertising pages of THE FOUNDRY. After a selection has been made, place a small trial order and at the same time request a formula be sent for the cores.

A good core should be permeable to gases, in fact cores are now frequently made without vents, being so open the smoke from a cigar can be blown freely through them, and still they will produce smooth interiors. In the case before us it is probable that too high a percentage of molding sand is being used. This sand is too close in nature to make cores when used alone. Use sharp sand freely and rub the surface of the cores with a good grade of plumbago made into a paste with molasses water.

Making Silicon Alloy

We desire information in regard to making the alloy of aluminum with from 5 to 13 per cent of silicon, as we do not know the manner in which the silicon is alloyed with the aluminum.

Probably the best method of producing alloys of silicon and aluminum is to use a *hardener* which is a rich alloy of silicon and aluminum, preferably 50 per cent of each, but some makers simply melt a portion of the aluminum to redness and add the silicon, heating as required to cause it to dissolve. Silicon dissolves quite easily in aluminum and it is much more easy to make an alloy of 50 per cent aluminum 50 per cent silicon than an alloy of 50 per cent copper and 50 per cent aluminum.

The less iron there is in the alloy the better. Therefore a high grade of silicon should be used. A great improvement is produced by the presence of a third element, and the one selected by the inventor of the alloy is sodium, but he adds this in the nascent state, by means of a *flux* which produces sodium in contact with heat and aluminum. Others add metallic sodium but this method is inferior to that of adding the element in a nascent state, or else this reaction differs with all reactions of a similar nature. Other elements can be used if preferred.

Wants Crankcase Alloy

We wish a little information regarding the alloy called duralumin as we are trying to make castings of this alloy for use where a strong mixture is wanted for crank cases and connecting rods. We have tested the alloy of 95.50 per cent aluminum; 3.50 per cent copper; 0.50 per cent manganese; 0.50 per cent magnesium, but find it to be too brittle for our purpose. Will it be better to leave out all the copper?

No, it would not be advisable to omit all the copper but merely to reduce it. In a paper presented before the American Institute of Mining and Metallurgical Engineers during the joint meeting with the American Foundrymen's association, Milwaukee, October, 1924, an alloy was mentioned by the authors of the paper, Samuel Daniels, E. A. J. Lyon, and J. B. Johnson which consisted of copper 2.5 per cent; magnesium 0.5 per cent; iron 1.25 per cent, and silicon 0.25 per cent. This metal in the sand cast condition possesses an ultimate strength of around 25,000 pounds per square inch with an elongation of about 5 per cent. Such an alloy probably would be the best to use where the alloy duralumin is specified, and we suggest a trial of this composition. The silicon is of course an impurity held by the aluminum ingot.

If another alloy can be substituted use aluminum 96.75 per cent; copper 2 per cent; manganese 1.25 per cent. There should be no difficulty obtaining 22,000 pounds tensile with from 6 to 8 per cent elongation with this alloy. An alloy of copper 2.5 per cent; zinc 7.5 per cent; aluminum 90 per cent, can also be used, or the regular copper 8 per cent, aluminum 92 per cent known as No. 12 aluminum alloy.

Bushings Are Porous

We have made several attempts to cast phosphor bronze bushings that would be free from porousness, but without sucess. We have used all virgin metals, and have tried ingot metal. The castings are about 12 inches long, 4 inches outside diameter and 2½ inches inside diameter. The cores seem to be all right, and the riser heavy enough and we believe they were poured at the right temperature.

A bronze bushing of the size mentioned is a very simple casting to make, and the best way to pour it is on an incline of about 2 inches from the horizontal, the pouring end being highest. The gate should be cut into the joint of the mold and connected into the side of the casting at the end. It should be cut double, always being made oval with the long side on the joint of the mold, half in the cope and half in the drag, or nowel. For a casting ¾-inch thick it is advisable to have both sprue and riser in a straight line and about 3 inches apart at the upper end of the mold.

The sprue should be about 1 inch in diameter, the riser 2½ inches, and connecting directly into the riser with the gate channel running at a right angle from the latter into the bushing. Have the cope at least 6 inches high; a little higher will do no harm. The size of the runner between the sprue and riser, and the gate into the bushing will be governed by the temperature at which the phosphor bronze is poured. If the metal is well phosphorized and is poured rather hot, it will cut into a green sand mold, so the molds will have to be well plumbagoed and then dried. The sand should be no finer than a No. 2 grade, and there should be 3 inches of sand over the pattern in the drag when it is rammed and the board bedded. If the melting is done in an oil-fired crucible furnace and the pot is pulled out in 35 minutes for a No. 70 or 80, no covering is needed on the metal. With a long melting period use plenty charcoal on the metal. If the castings come porous after following the above suggestions, there is something radically wrong with the melting process.

Patternmaker Uses Calipers

for Exact Measuring

Compass Also Has Found Place in Woodworker's Kit Since Days of the Early Egyptians

By Walter C. Ewalt

EXCEPTIONS may be made to the statement that the measurements made by patternmakers when building wood patterns seldom are closer than ½ of 1/64-inch or 1/128-inch. In many cases the drawings call for much greater accuracy in pattern construction. If the worker uses rules altogether in making measurements, it will be necessary for him to estimate when close work is required. For this reason measuring devices such as micrometers and calipers are used. These tools may be used in measuring from 1/1000 to 1/10,000 of an inch. Ordinarily the worker making patterns in wood does not require these tools, but if measurements of 1/128-inch or less are required, the caliper shown in Fig. 1 is necessary. This tool is called either a sliding or beam caliper, or a caliper square.

In 1631, Pierre Vernier, a Frenchman, invented a device by which readings may be made in ten-thousandths of an inch. We are likely to think that the vernier caliper and the micrometer are modern tools, but like many other devices, are old principles applied to a new construction. This device derived its name from the inventor, who described it in a tract printed in Brussels in 1631.

The instrument is made in two parts, as may be seen in Fig. 1. The two parts slide past each other in measuring, and carry a graduation on the contact edges. The sliding scale for obtaining the smaller fractional parts of the subdivisions of

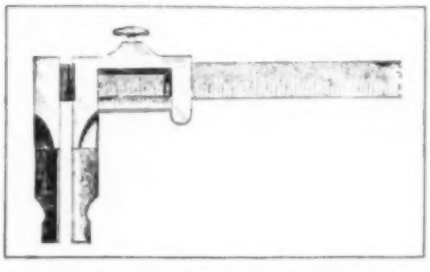


FIG. 1—THE VERNIER CALIPER IS MADE IN TWO PARTS

the fixed scale, may be divided into a number of equal parts, either one more or one less than the corresponding length of the fixed scale. The position of one end between two scale marks is indicated by the coincidence of one of its scale marks with the mark on the fixed scale. On the caliper shown in Fig. 1, eight equally divided spaces on the sliding head represent a total distance of 7/16 inches. Seven divisions are marked on the beam, each 1/16-inch wide. Therefore the difference between one division on the sliding head and one space on the beam is 1/128-inch.

The first line or index line on the vernier is used to read the sixteenths. When the index line shows beyond a graduation on the beam scale and when the next line to the index on the vernier coincides with one of the sixteenth lines on the beam scale, then 1/128-inch is added to the measurement indicated by the index line. If the second line coincides, add 2/128-inch and if the third line coincides add 3/128ths, and so on.

In Fig. 2, the measurement between the jaws equals 1 15/128, because the seventh line on the vernier from the index line corresponds or coincides with a division line on the beam scale, which, in this case, happens to be on the 1½-inch line.

In Fig. 2 the starting or index line on the beam is 7/16 inches from the inside of the fixed caliper jaw. It is

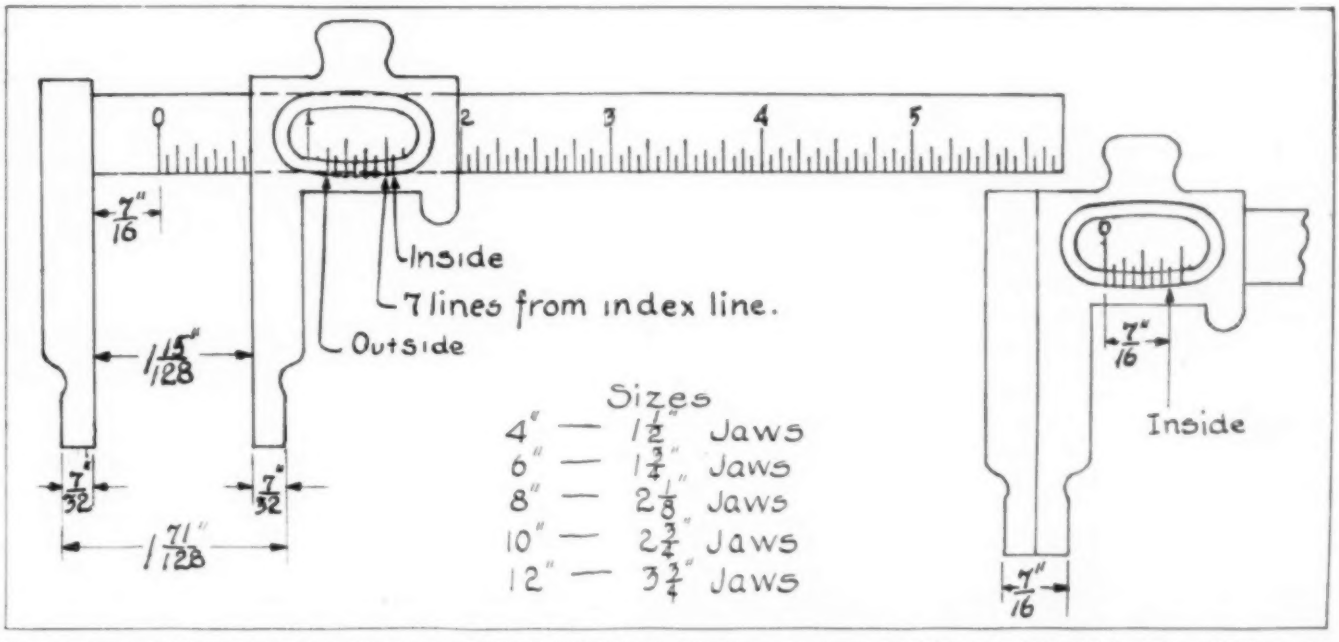


FIG. 2-3—THE CALIPERS MAY BE USED TO MEASURE INSIDE OR OUTSIDE OF THE OBJECT BY CHANGING THE METHOD OF READING ON THE SCALE

placed there so that the instrument may be suitable not only for outside but also for inside measurements. The combined thickness at the offset ends of the jaws measures 7/16 inches. Consequently when the jaws are closed tight, the index line on the vernier will coincide with the index line on the beam and the distance across the lower ends of the jaws will be 7/16 inches. Thus it may be seen that 7/16-inch is the smallest inside dimension which may be measured with this particular tool. However, any measurement larger than that may be made up to the limit of the beam as shown in Fig. 3. On the caliper shown in Fig. 3, the jaws are 7/16 inches. When the vernier is read, it may be noted that the last line to the right reads 7/16-inch. Therefore the line to the left is the index line for reading when measuring inside dimensions. If the setting in Fig. 2 is for measuring the inside dimensions, we see that the index line to the right does not touch 1 9/16 or 1 72/128. However, the next line to the left coincides with the 1½-inch mark. As that mark represents 1/128-inch we deduct 1/128-inch from 1 72/128 inches which leaves 1 71/128.

The sliding head is adjusted and secured to the beam by a thumb screw which screws against a flat spring key. This simple arrangement keeps the jaws from wearing loose and does not mar or damage the scale. The jaws are hardened sufficiently to prevent undue wear from continued use and are long enough to measure in and out of many pieces of work. Measurements may be taken quickly, with one hand holding the work and the other the tool. The caliper is valuable in duplicating work where numbers of pieces of the same size are wanted. The patternmaker will find this tool valuable.

There are some tools, for example the calipers, which the patternmaker may do without, as he may use dividers and scales to get practically the same results. However, there are other tools which almost are indispensible, one of which is the divider or compass. The compass is an instrument for describing circles and transferring measurements. It consists of two pointed legs or branches, and the patternmaker is supposed to supply the head. These legs are joined at the top with a pivot by which they are opened and closed, as shown in Fig. 4. The compass is an extremely old tool and in ancient times was used commonly by carpenters and masons. This instrument undoubtedly was known to the Egyptians and used in drawing, architecture and in the construction of their buildings and temples. Many tombs and buildings are full of illustrations which show that the compass was made.

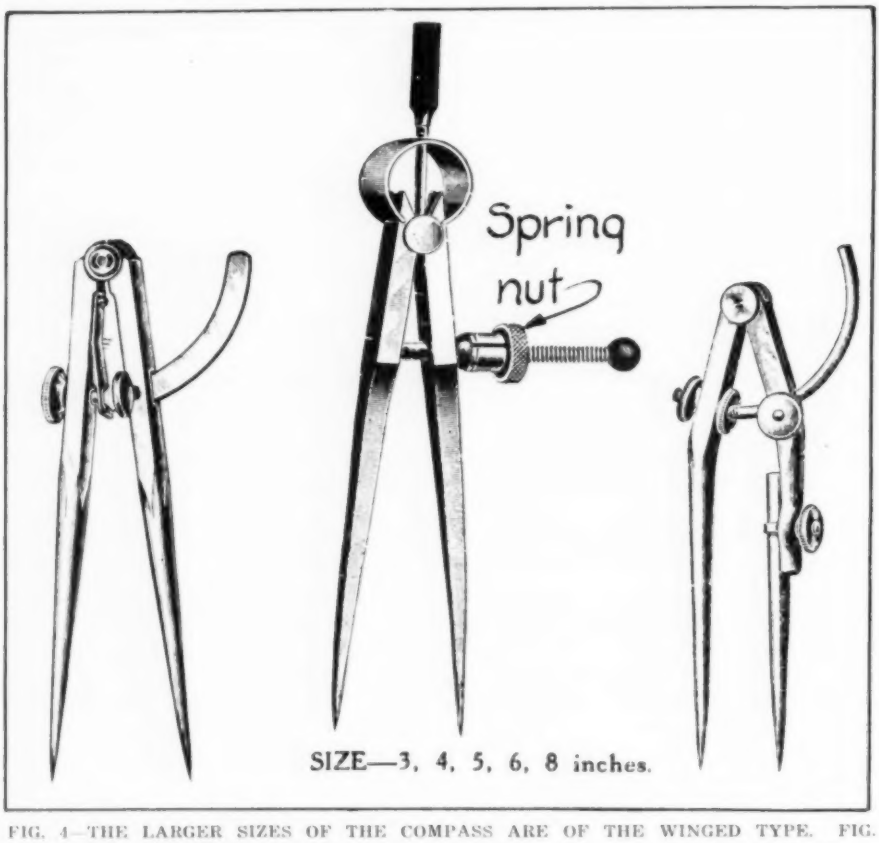


FIG. 4—THE LARGER SIZES OF THE COMPASS ARE OF THE WINGED TYPE. FIG. 5—THE SPRING DIVIDER HAS A SPRING NUT. FIG. 6 A PENCIL MAY BE USED WITH CERTAIN TYPES OF DIVIDERS

Mark Twain once gave a lecture in Egyptian hall, London, England, and started out by saying "When the Egyptians built this hall." This was as far as he got for some time because that statement struck his audience as being funny. When we read of the discoveries of buried treasures, tools and instruments, it does not seem strange to think that nearly all we have has been handed down to us. Many a true word is spoken in a jest, and maybe Mark Twain felt the spirits of those old Egyptians and gave them their just dues. We read of the descriptions of the tomb of Ben Hassan, built about 1706 B. C., the Thebes built about 1500 B. C., with their illustrations showing the uses of compasses. From these, and many other objects, enough evidence has been uncovered to show clearly that compasses were used prior to the most anciently known date placed upon those old temples and monuments of Egypt. Nearer to us in years was a Roman tomb which was discovered with compasses, calipers, plumb rule, square, mallet and chisel shown on it.

The architect and engineer may determine accurately the right proportions with the compass. With accurate measurements accomplished by the compasses, beauty, strength and symmetry are attainable. On the lay-out board, in building the pattern and turning in the lathe, the compass will be in almost constant use.

Some patternmakers have several sizes of dividers ranging from 2 to 8 inches, and in some cases several of the same size may be found in the kit. The woodworker often makes the end of one leg broad like the point at the end of a knife blade. This kind of marker makes a smoother mark in the wood then if brought down to a sharpened pin point. The sizes are designated by the length of the legs. For the larger sizes as shown in Fig. 4, the winged dividers usually are obtained. This type is stiffer than the spring dividers which are used for drawing small circles and for spacing. The spring dividers are shown in Fig. 5. In addition to making circles, arcs, spacing and measuring, the dividers may be used for scribing parallel lines as in marking for a chamfer, round, or curves. One leg is held against the edge while the other leg marks the line. A divider, as in Fig. 6, is constructed

(*Concluded on Page* 372)

Milestones in Foundry Progress

As Recorded in the May Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago

1896

GROVER CLEVELAND

TRANSITION from the method of judging iron by fracture to the acceptance throughout the trade of analytical grading is reflected in a discussion at the April meeting of the Western Foundrymen's association reported in THE FOUNDRY of May, 1896. Complaint was voiced that furnaces were furnishing iron for which certain analyses were claimed, but which by fracture did not check with the foundrymen's desires. It was claimed that off Bessemer grades were being substituted to the injury of foundry mixes.

* * *

Business was bad and price cutting was rampant with the usual penalty of many shops turning over their keys to the sheriff.

* * *

Two types of plain squeezer molding machines were described for the first time. Another innovation was a mechanically operated rectangular riddle, suspended at four corners from an overhead frame, by rods mounted with ball joints. This riddle was actuated by an overhead, belt-driven shaft which turned a crank operating a frame rigidedly attached to the riddle, giving it a gyratory motion.

* * *

RUTHLESS RHYMES

"Hands off the pulley belt,
Fingers off the gears."
Meant naught to Westerfelt,
Hence his widow's tears!

A. V.

* * *

No. 2 foundry iron was quoted at $12.00 to $12.50 a ton, Pittsburgh.

* * *

Edgar C. Seebohm, sent to Johannesburg to install woodworking machinery shipped by J. A. Fay & Egan Co., Cincinnati, narrowly escaped arrest by the Boers who thought his band mill some kind of a gun. War was brewing between England and South Africa.

Faked Foundry Facts

The Door Prop

Almost any cupola can be made to melt 14 to 1, but it takes a Jim Slicker to pour such iron and get a casting out of it. I consider him a first class man who first gets his iron hot, then works his bed and charges of fuel down to the lowest limit, still keeping the iron hot.

G. BUSCH.

1906

THEODORE ROOSEVELT

A COMPLETE description of the newly completed foundry of Ingersoll-Rand Co., Phillipsburg, N. J., was featured in the May, 1906 issue of THE FOUNDRY. Iron and brass castings were manufactured.

* * *

The 1906 convention and exhibition of the American Foundrymen's association was announced to take place in Cleveland, June 4 to 7. This was the eleventh annual meeting.

* * *

John P. Frey, editor, *International Molders' Journal*, Cincinnati, contributed a number of interesting photographs of ancient bronze castings such as braziers, firepots, hot water urns and waterbacks, found in the ruins of Pompeii, which was buried in the eruption of Mt. Vesuvius A. D. 80. The volcano again was active in 1906, just previous to the appearance of the article mentioned.

* * *

The trace of antique influence on modern design may be noted in the ornamental work on the hard coal stove of twenty years ago.

* * *

H. E. Field, then chief chemist, Mackintosh-Hemphill & Co., Pittsburgh, described the ideal qualities of molding sands. Typical analyses were given.

* * *

No. 2 foundry iron was quoted at $16.50 a ton Pittsburgh.

* * *

R. H. Palmer resigned his position with Derkins Machine Co., Warren, Mass. to become foundry foreman of R. Roe & Co., Brooklyn.

* * *

Mr. Palmer, long a contributor to THE FOUNDRY, *and the author of works on foundry practice now resides in Bridgeport, Conn.*

1916

WOODROW WILSON

STANDARD CRUCIBLE STEEL CO., Milwaukee, had installed a 2-ton, open-hearth furnace, designed by David McLain and Frank Carter. This furnace which had been in operation only about a month was described in the May, 1916 issue of THE FOUNDRY.

* * *

The week of Sept. 11 was announced as the date of the Cleveland convention and exhibition of the American Foundrymen's association.

* * *

This was the twenty-first annual gathering and the second held in Cleveland since the establishment of the association in 1896.

* * *

Charles Vickers, then connected with the Titanium Alloy Mfg. Co., Niagara Falls, N. Y., had devised a permanent mold of graphitized carbon.

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ As Others See Us

FOREIGN visitors often comment upon the interest evidenced in their opinions of American institutions, habits, customs and industrial pursuits. Secretly flattered by the artless questions of newspaper interviewers who meet them at the gangplank of incoming steamers with an inquiry like, "What do you think of prohibition in the United States," they feign tolerant amusement or affronted pompousness, as the case may be, and expound for columns. How different is the opinion of two young Englishmen who after an extended tour and close study of industry set forth nine reasons for American industrial progress as follows:

One—Promotion in America is by merit.

Two—America sticks to the principle of small profits and quick returns, and wealth is made by fine margins of profit on immense and rapid turnover.

Three—Rapid turnover is secured by simplification and cheapening of processes which necessitates less capital for a given output.

Four—America shows endless keenness in devising time-saving and trouble-saving appliances.

Five—The American employer is not hostile to high wages.

Six—American manufacturers co-operate by exchanging ideas.

Seven—Americans are vigilant and acute in eliminating waste and in conserving time, energy and space.

Eight—American welfare methods double high wages in their stimulative effect by surrounding the workers with cleanliness and light and by seeking in every way to increase their convenience and satisfaction.

Nine—Americans encourage research with magnificent intelligence, scouring the world to obtain the best research brains.

THESE nine articles, which constitute an ideal or creed of America's industrial accomplishment might be summarized in the Golden Rule of mutual as well as self-advancement. This is stated in the sixth article:

American manufacturers co-operate by exchanging ideas.

All of the other points observed by these students from across the seas have had their instance, growth of realization through some application of this sound principle.

¶ What Do You Do?

MANY foundrymen fail to realize that methods and machines, after a certain period of usefulness, become obsolete and are a distinct liability. Sir Auckland Geddes, an eminent English financier, recently said, "though business is sound we dare not go on doing business as in the past. We must improve technical, metallurgical practice and learn to scrap and replace out-of-date machinery which is expensive to operate." This statement applies to the foundry as well as to any other industry.

NEW methods are gaining ground. Years ago little was known of centrifugal and permanent mold casting, and still less of die casting. For certain classes of work these methods are the cheapest and the castings turned out are given qualities that fit them better for their intended service. Research and methods of metallurgical control in recent years have put the foundry industry on a higher plane. To meet competition the foundryman must produce castings that conform to standard design and requisite physical and chemical specifications.

OBSOLETE molding equipment is a severe drain upon profits. Unless costs are kept it sometimes is hard to realize that the machine is a burden rather than a money making aid. Repairs are expensive. No foundryman would operate an automobile of the vintage of 1910 with its huge cylinders and antiquated gas-hungry carbureter. The first thing he would notice would be the upkeep expense, and if many repairs were necessary, he would hasten to rid himself of the white elephant. Does the average foundryman think of his old equipment in the same light? Indeed, he does not. He uses it until no more repairs can be made, and then he regretfully scraps it. Instead of doing this the foundryman should discard it as soon as its period of usefulness is over. He also should study the latest methods and apply those giving him the best value in his particular service.

METHODS FOR ANALYZING FERROALLOYS

FERROMANGANESE

(Concluded from Data Sheet No. 618)

Determination of Sulphur by the Oxidation Method

Proceed as in the determination of sulphur by the oxidation method as described in the standard methods of chemical analysis of plain carbon steel (serial designation: A 33) of the *American Society for Testing Materials*.

NOTES

Routine determinations of sulphur can be made by the evolution method provided concentrated hydrochloric acid (sp. gr. 1.19) is used, preferably in all-glass apparatus of the Pulsifer type.

Determination of Silicon by the Nitro-Sulphuric Acid Method

SOLUTIONS REQUIRED

Nitro-Sulphuric Acid.—Pour 160 cc. of sulphuric acid (sp. gr. 1.84) slowly and with stirring into 660 cc. of water and add 180 cc. of nitric acid (sp. gr. 1.42).

METHOD

Dissolve 0.9352 g. of the sample passing a No. 100 sieve with 50 cc. of the nitro-sulphuric acid in a 250-cc. porcelain casserole and evaporate until copious fumes of sulphuric acid are evolved. After the solution has cooled somewhat add 125 cc. of distilled water and 5 cc. of HCl (sp. gr. 1.19). Heat with frequent stirring until all salts are dissolved and immediately filter on a 9-cm. paper. Wash the precipitate with cold dilute HCl (5:95) and hot water alternately to complete the removal of soluble salts, and finally with hot water until free from acid. Transfer the filter to a platinum crucible, char the paper carefully, and finally ignite with the crucible covered over a blast lamp or in a muffle furnace at 1050 to 1100 degrees C. for at least 10 minutes; cool in a desiccator and weigh. Add sufficient dilute sulphuric acid (1:1) to moisten the silica and then a small amount of hydrofluoric acid. Evaporate to dryness, ignite and weigh. The difference in weights divided by 2 and multiplied by 100 represents the percentage of silicon in the alloy.

NOTE

For silico-manganese and manganese-silicon, fuse 0.4676 g. of the former or 0.2338 g. of the latter with 8 g. of sodium peroxide in a pure iron crucible. Dissolve the fusion and evaporate to fumes of sulphuric acid. When acidifying the solution of the fusion with sulphuric acid it is necessary to add some sulphurous acid to dissolve the manganese dioxide which separates out.

METHODS FOR ANALYZING FERROALLOYS

FERROCHROMIUM

Determination of Chromium by Fusion With Sodium Peroxide

SOLUTIONS REQUIRED

Potassium Permanganate, 0.1 N.—Dissolve 3.2 g. of potassium permanganate in 1000 cc. of distilled water, allow to age for at least ten days and filter through purified asbestos. Standardize the permanganate solution against bureau of standards standard sodium oxalate as follows:

In a 400-cc. beaker dissolve 0.25 to 0.30 g. of sodium oxalate in 200 to 250 cc. of hot water (80 to 90° C.) and add 10 cc. of dilute H_2SO_4 (1:1). Titrate at once with the permanganate solution, stirring the liquid vigorously and continuously. The permanganate must not be added more rapidly than 10 to 15 cc. per minute, and the last 0.5 to 1 cc. must be added dropwise, with particular care to allow each drop to fully decolorize before the next is introduced. The excess of permanganate used to cause an end point color must be estimated by matching the color in another beaker containing the same bulk of acid and hot water. The temperature of the solution should not be below 60° C. by the time the end point is reached. One cubic centimeter of 0.1 *N* $KMnO_4$ is equivalent to 0.001733 g. of chromium.

Standard Ferrous Ammonium Sulphate.—Dissolve 43 g. of the salt in 250 cc. of cold water, add 40 cc. of sulphuric acid (1:3), dilute to one liter with distilled water, and mix thoroughly. Large amounts of the solution can be mixed conveniently by means of a stream of carbon dioxide from a cylinder. As the ferrous ammonium sulphate solution gradually weakens in reducing power it is necessary to standardize it daily or at the same time the ferrochromium is analyzed. The solution can be standardized against either potassium dichromate or sodium oxalate.

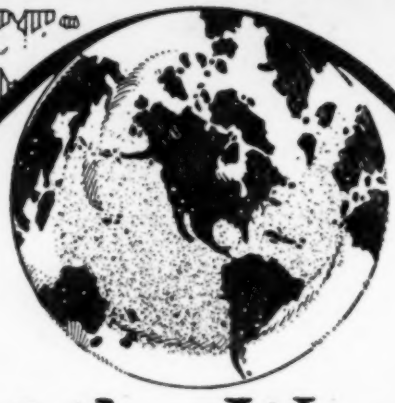
The first method is somewhat simpler and more satisfactory for routine work as the conditions prevailing in both the standardization and in the analysis are practically identical. No *blank* corrections are afterward necessary where the amounts of dichromate, ferrous salt and permanganate are approximately those prevailing in the analysis. The second method is employed chiefly for checking the accuracy of the results obtained with potassium dichromate and in cases where only occasional analyses are made and pure dichromate is not readily available.

To prepare pure potasssium dichromate, recrystallize at least twice the purest grade of the salt obtainable, dry the crystals at 150° C., grind to a fine powder and again dry at 150° C. to constant weight. Keep the prepared salt in a ground-glass stoppered bottle. Transfer 1.0000 g. of the pure dichromate, which contains approximately the same amount of chromium as an 0.5000-g. sample of 70-per cent ferrochromium, to an 800-cc. beaker. Dissolve in cold water, acidify with 40 cc. of sulphuric acid (1:3) and dilute with cold water to 500 cc. Add a slight excess of the ferrous sulphate solution, approximately 190 cc., and titrate the excess ferrous salt with 0.1 *N* permanganate to the first faint permanent darkening of the clear green color.

(Continued on Data Sheet No. 621)

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

THE FOUNDRY DATA SHEET, MAY 1, 1926
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication



Around the World with The Foundry

Little Journeys to the homes of our readers

Scotland

ROAR of riveting guns along the Clyde, clouds of smoke by day and pillars of fire by night, hovering over the great industrial Glasgow district offer a marked contrast to conditions obtaining in the days when the Knights of Branksome Hall "Carved at the meal with gloves of steel and drank the red wine through the helmets barred;" when Tam O'Shanter fled for his life over the Auld Brig o' Ayr; when moss troopers riding by day and night harried the border side and blithely sang "Blue Bonnets Over the Border"; when gallant gentlemen displayed the white cockade in the '45 and swung Scotland's broad claymore in the ill fated cause of Bonnie Prince Charlie.

The country's fame in recent years has been built on a more enduring if less romantic foundation. The product of her looms and spindles, her blast furnaces and rolling mills, her immense shipyards, have been sent broad cast over the world and—to slightly paraphrase her most famous poet—Breathes there a man with soul so dead who never has heard the name of Johnny Walker. The foundry industry has been developed to a high state of perfection and it is no surprise to find that THE FOUNDRY circulates twice a month in 138 out of the 364 shops in the country.

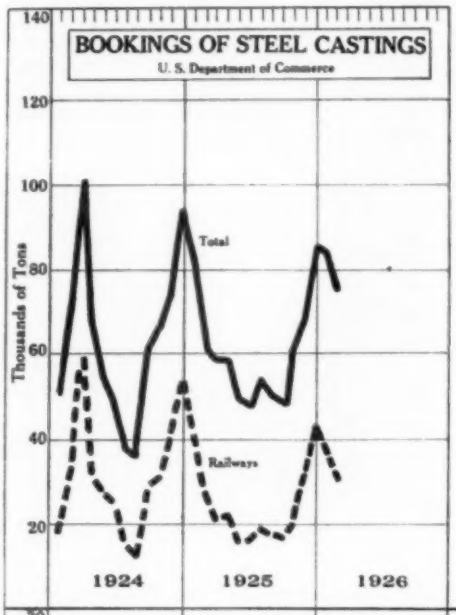
"Wherever metals are cast you'll find THE FOUNDRY"

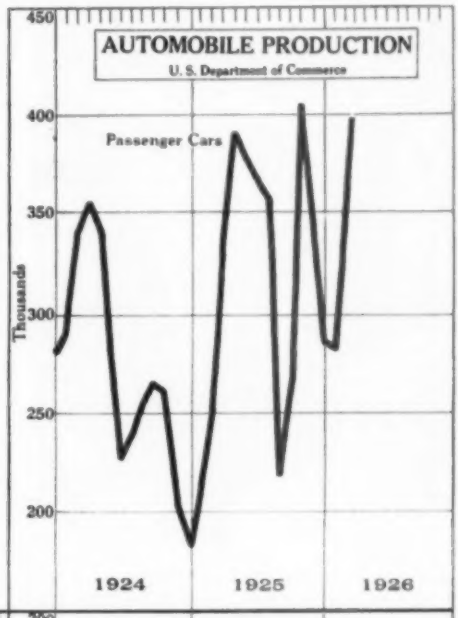
Trade Trends in Tabloid

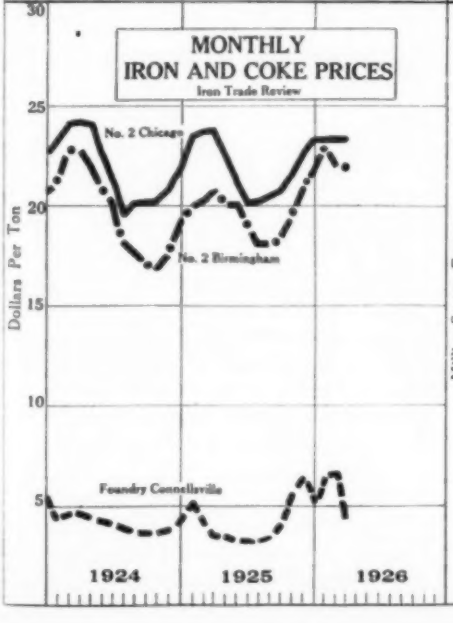
FOUNDRY operations throughout the country are holding practically a steady level, although backward spring weather and the heavy production during the first three months of the year are factors causing slight letdowns in several lines. While a sharp curtailment not yet is in evidence in the automobile industry, apparently total sales failed to balance the recent high production rate, and only an increased buying movement will permit a continuation of the March output. After a fairly active first quarter, operations in stove foundries have been decreased, and malleable plants in one section of the country are letting down slightly. The average melt in Ohio as reported by the Ohio State Foundrymen's association was 90.3 per cent of normal in March as compared with 73.9 per cent in February. Stocks of materials received increased from 69.1 per cent in February to 78.1 per cent of normal during the third month of the year. Stocks on hand March 31 were 111 per cent of normal and nonferrous foundries were operating at 66.4 per cent of normal. While implement makers are busy, better weather conditions are necessary for the distribution of this line. A total of 118,076 bathtubs and 130,496 sinks were ordered in March, directly reflecting the increase in building construction, which now is going forward in large volume. Pig iron prices again have declined slightly.

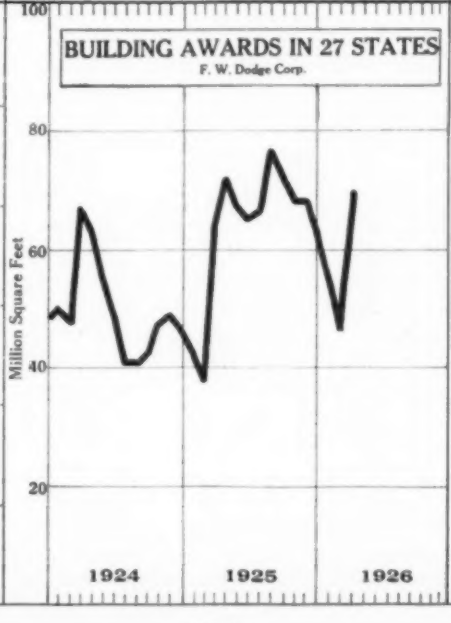
RAW MATERIAL PRICES
APRIL 21, 1926

Iron	
No. 2 foundry, Valley	$19.00
No. 2 Southern, Birmingham	21.00 to 22.00
No. 2 foundry, Chicago	22.00
No. 2 foundry, Philadelphia	22.76
No. 2 foundry, Buffalo	21.00
Basic, Valley	18.50
Basic, Buffalo	20.00 to 20.50
Malleable, Chicago	22.00
Malleable, Buffalo	21.00
Coke	
Connellsville foundry, coke	$4.00 to 4.50
Wise County foundry, coke	4.25 to 5.50
Scrap	
Heavy melting steel, Valley	$16.50 to 16.75
Heavy melting steel, Pitts	16.50 to 17.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	15.75 to 16.00
No. 1 cast, New York	14.00 to 14.50
No. 1 cast, Chicago	18.75 to 19.25
No. 1 cast, Philadelphia	18.00 to 18.50
No. 1 cast, Pittsburgh	17.00 to 17.50
No. 1 cast, Birmingham	17.00 to 17.50
No. 1 cast, Buffalo	15.50 to 16.00
Car wheels, iron, Pittsburgh	17.00 to 17.50
Car wheels, iron, Chicago	16.25 to 16.75
Railroad malleable, Chicago	17.50 to 18.00
Agricultural, mal., Chicago	16.50 to 17.00
Malleable, Buffalo	21.00 to 22.00
Railroad Malleable, Pitts	18.50 to 19.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.35
Electro copper, producers	18.87½ to 14.00
Straits tin	63.00
Lead, New York	7.85
Antimony, New York	17.25 to 17.50
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	26.50
Aluminum, No. 12, remelt	24.00 to 24.50
Zinc, E. St. Louis, Ill	6.90 to 6.95









Comings and Goings of Foundrymen

JOHN W. GUAY, formerly sales engineer of the Fort Pitt Steel Casting Co., McKeesport, Pa., now is works manager of the firm. Mr. Guay has had 18 years of diversified experience with the Fort Pitt company both in sales and operating departments. Previous to his connection with this firm, he was in the mechanical department of the Pennsylvania railroad.

H. F. Stratton, formerly general foreman of the pattern, mold and

JOHN W. GUAY

core department, Fort Pitt Steel Casting Co., McKeesport, Pa., has been appointed superintendent. Mr. Stratton was graduated from the mechanical engineering department, Purdue university, Lafayette, Ind., and joined the Fort Pitt company in 1920. Previously he had been connected with the Isaac G. Johnson Co., Spuyten Duyvil, N. Y., for several years.

R. R. Clarke, superintendent of alloys foundry, General Electric Co., Erie, Pa., recently spoke before the Philadelphia Foundrymen's association on true workmanship.

S. J. Moore, formerly associated with the Sivyer Steel Casting Co., Milwaukee, has been appointed sales manager for the Oklahoma Steel Castings Co., Tulsa, Okla.

Dr. Richard Moldenke returned from a European trip on April 13. During his tour abroad he visited foundries in Norway, Sweden, Germany, Czecho-Slovakia, Switzerland, Italy, France and England. He reports that great interest is being taken in the coming International Foundrymen's congress to be held in Detroit, and that many Europeans will attend.

F. V. Pfieffer, formerly with the Hyde Park Foundry & Machine Co., Hyde Park, Pa., has accepted a position as assistant foreman in the green sand core department of the Ferro Machine & Foundry Co., Cleveland.

Watch for This

THE FOUNDRY *has secured for publication an unusual metallurgical paper, covering phosphorus in iron. This interesting metalloid for many years has been the object of much discussion both flattering and libelous. In this paper which will be published in two sections, the first appearing May 15, a younger metallurgist who has achieved considerable success in the study of gray iron will present the story of phosphorus. His summary of past experiences and the presentation of his own observations are given in an easily understood style.*

To Hold Exhibition

The second chemical equipment and process engineering exposition will be held in the Public hall, Cleveland, from May 10 to 15. Machinery, equipment, materials, supplies, etc., that enter into this industry will be shown. In connection with the exposition a program of technical sessions sponsored by the Associated Technical Societies of Cleveland will be held.

Discuss Trade Problems

The twentieth annual convention of the National Metals Trades association was held in the Hotel Astor, New York, April 15 and 16. The opening session was given over to executive and committee reports in which such questions as, industrial relations, industrial education and industrial accidents were discussed. Reviewing conditions in the metal trades, Paul C. DeWolf, president, said that replies to a questionnaire indicated a promising outlook for the next six months. Out of 430 replies, 34 reported prospects as excellent, 211 good, 190 as fair and but five as poor.

The speakers at the sessions were John W. O'Leary, United States chamber of commerce; Hon. Ogden L. Mills, New York; Dr. Clarence L. Robertson, Shanghai, China; W. Irving Bullard, Boston, and Virgil Jordan, national industrial conference board who discussed the agricultural situation.

H. F. STRATTON

Appointed Engineer

W. F. Prince recently has been appointed equipment engineer of the J. W. Paxson Co., Philadelphia. For many years Mr. Prince has been engaged in consulting practice in both iron and brass foundries. Previously he had charge of the various foundries of the Worthington Pump & Machinery Corp., New York, for several years. These foundries are located at Harrison, N. J., Cambridge, Mass., Holyoke, Mass., Lockport, N. Y., Buffalo, N. Y., and Cincinnati, O. Later he had charge of foundries of the Crane Co., Chicago.

Surprised at Luncheon

Foundrymen in the St. Louis district recently were entertained at a novel luncheon at the Missouri Athletic club. The guests were summoned by Charles Fitzgerald, local representative of the Sloss-Sheffield Steel & Iron Co., with invitations stating that important federal matters were to be considered. Apprehensions were rife, but no difficulties were encountered. After the dinner, Russel Hunt, secretary and treasurer of the company, distributed checks totaling over $25,000 among the foundrymen.

This was the result of a recent United States Supreme court decision on overcharges by the railroads on pig iron hauled during the period 1910-1915. The excess was ordered turned over to the iron company and in turn the firm paid to its customers their portion of the rebate.

Holds Annual Convention

Southern Metal Trades association will hold its ninth annual convention in Macon, Ga., May 5 and 6. The opening session will be held Wednesday morning at 9:30, and will be devoted to officers reports and addresses on various subjects. Included in the addresses will be, Foundry Management and Its Effect on Costs, by W. J. Barrett, New York; Costs, by J. S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; Refining Molten Cast Iron, by G. S. Evans, Mathieson Alkali works, Chicago; Importance of Uniformity of Coke by E. J. Rowe, Adams, Rowe & Norman, Birmingham, Ala.; Modern Foundry and Machine Shop Construction, by C. A. Harwick, H. K. Ferguson Co., Cleveland, and The South Awake, by Russel Hunt, Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.

Wednesday afternoon the plants of the J. S. Schofield's Sons Co. and the Taylor Iron Works & Supply Co., will be visited. The evening will be devoted to the annual banquet, and the meeting will close on Thursday.

Physicist Has a Place

At the recent monthly meeting of the Metropolitan Brass Founders association, New York, R. R. Clarke, superintendent, alloy foundry, General Electric Co., Erie, Pa., expressed the opinion that the foundry presents a great opportunity for the physicist. He said that the physicist would take his place with the chemist and metallurgist in developing foundry practice. In an illustrated address Mr. Clarke demonstrated that by the application of physical laws to casting he overcame many obstacles. Mr. Clarke discussed various phases of brass melting and said he believed in pouring the metal hot, but not at a white heat. His experience showed that cold poured metal made a satisfactory appearance in the rough, but machining frequently revealed many flaws.

Philadelphians Meet

At the regular monthly meeting of the Philadelphia Foundrymen's association held at the Engineers club on April 14, R. R. Clarke, General Electric Co., Erie, Pa., gave a blackboard sketch and talk on true workmanship. Walter Wood, R. D. Wood & Co., Philadelphia, explained the further steps necessary to establish blast furnaces at Philadelphia.

Officers Are Elected

Quad-City Foundrymen's association recently held its annual meeting at the Rock Island Arsenal, Rock Island, Ill. The dinner and meeting were attended by 175 members. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, spoke on malleable iron. The following officers were elected: President, J. H. Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa; Hyman Borstein, Deere & Co., Moline, Ill., vice president, and secretary-treasurer, A. D. Ziebarth, Davenport Foundry & Machine Co., Davenport, Iowa.

Obituary

F. S. Mills, president of the Southbridge Foundry Co., Southbridge, Mass., died recently.

C. E. Randall, president of the Knox Stove Works, Knoxville, Tenn., died recently.

Willis G. Knight, H. W. Knight & Son Metal Pattern Letter Works, Seneca Falls, N. Y., died recently at the age of 57.

Patrick Maher, proprietor of a machine shop and foundry in Jamestown, N. Y., for more than 40 years, died recently at the age of 90. He was born in Ireland March 19, 1836, and came to the United States in 1847. He opened his first foundry in 1886 and was active in the industry until three years ago.

George Mitchell, president, Pittston Stove Co., Pittston, Pa., recently died at his home in Scranton, Pa. Mr. Mitchell became a director in the stove company in 1888 and in 1892 he was elected president. During his long affiliation with the stove manufacturing industry he gained a reputation as an authority and frequently acted in a consulting and advisory capacity in the construction of stoves and ranges. Mr. Mitchell also served as president of the Scranton school board.

Foundry Association Directory

The Buffalo Foundrymen
Buffalo

President, J. McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, CHARLES L. LARSEN, Armour Institute of Technology 3200 Federal street, Chicago; secretary-treasurer, E. C. BARRINGER, THE FOUNDRY, 1147 Peoples Gas building, Chicago. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry, Co., 131 South Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Foundry Association
New York

President, THOMAS HARPER, Thomas Harper, 204 Lafayette street, New York; secretary, WM. E. PAULSON, Thomas Paulson & Son, Inc., 97 Second avenue, Brooklyn, N. Y. Meetings second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry, Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meetings called by president.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, CHARLES R. SPARE, Janney Cylinder Co., Holmesburg, Phidadelphia; secretary, HOWARD EVANS, J. W. Paxson Co., Luzerne and D street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, WILLIAM K. FRANK, Damascus Bronze Co., South avenue, N. S. Pittsburgh; secretary-treasurer, WM. J. BRANDT, Wm. J. Brandt, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August, at the Fort Pitt hotel.

Quad-City Foundrymen's Association
East Moline, Ill.

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island, and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, W. C. TROUT, Lufkin, Tex.; secretary-treasurer, W. E. DUNN JR., Henley building, Atlanta, Ga. The 1926 convention to be held at Macon, Ga., the date to be announced later.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, J. A. TEACH, Minneapolis Steel & Machinery Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, So., Minneapolis. Meetings monthly at the Athletic club.

Molding Sand Supplied Continuously

(*Concluded from Page* 350)

wide rubber belt which discharges into the boot of an elevator at the foot of the bin marked *A* is Fig. 4.

A magnetic separator at the end of the belt removes any pieces of scrap before the sand falls into the boot. Sand from the elevator falls into a bin *A* through a revolving screen which aerates it to a certain extent and removes lumps of foreign material. The screen discharges the sand upon a horizontal circular plate equipped with a pair of curved arms that spread the sand into a thin layer that cools rapidly. The arms gradually work the sand toward the periphery of the plate from which it falls into a storage bin.

Sand Preparation Plant

An elevator lifts the sand on to a wide belt which carries the sand to the bar mill *C*. This mill is partly filled with a number of long 3-inch steel rollers that ride with and among the sand and impart the necessary mulling effect. The necessary water is added to the sand through a small pipe at the loading end of the mill. A hopper beneath the floor is kept filled with new sand and a small auxiliary elevator driven by a variable speed motor is employed to discharge a stream of new sand on the same belt that carries the old sand to the mill. By varying the speed of the motor the amount of new sand may be varied at will.

The mill is mounted on a slight incline and discharges a steady stream of prepared sand into an elevator which carries it either into the storage bin *D* or on to a cross belt which supplies the main belt running over the hoppers on the four remaining molding units on the other side of the sand preparation plant. The bin is slotted from top to bottom and the buckets of the elevator working a little distance inside this slot continuously cut through the ring of sand and prevent it from banking.

The elevator is of a special type developed by the Osborn Mfg. Co., first as a flask filler. Cast steel links and buckets operate in a substantial, cast iron frame designed to withstand the exceptionally heavy service incident to foundry operation. It is driven by a variable speed motor to accommodate fluctuations in the load at different periods.

A photographic view of part of the sand distribution system which serves four miscellaneous molding units is reproduced in Fig. 5. The two units shown are those marked *cylinder heads and manifolds* above and *miscellaneous castings* below in the upper right part of the general layout Fig. 4. The two remaining units are devoted to the production respectively of fly wheels and clutch casings above and transmissions and gear casings below.

Two shakeout stations are located in the 10-foot gangway which separates the two pairs of conveyors. They are equipped and operated in the manner previously described. Sand falls upon two short lateral belts which deposit it on the main underground belt leading to the tank marked *B* Fig. 4. The flasks are returned to the proper conveyor which takes them to their respective molding stations. The castings from these units are comparatively light and the attendants easily pull them with long hooks and drop them through an opening in the floor where a steel flight conveyor carries them through an opening in the side wall of the building and discharges them onto a second conveyor shown in Fig. 6. This conveyor takes them close to the end of the building where they are removed by hand and loaded into trucks and then removed to the cleaning department.

Patternmaker Measures With Calipers

(*Concluded from Page* 366)

so that a pencil may be substituted for the steel point. Both the terms compass and dividers are indifferently applied to the same tool but there is a distinction between them. The true use for a compass is to describe circles and arcs and the dividers are to divide lines into equal lengths.

If a slight amount of care is given these instruments, they should last indefinitely. For example, in adjusting the spring dividers to a length on a rule, the points at first should be opened, holding back the spring in the legs with one hand while unscrewing either the solid nut, not shown, or sliding back the spring nut. This takes the strain from the threads on the screw. Do not allow the dividers to touch the rule when this is being done. When the dividers have been opened, close to the measurement desired, then place one point into one of the marks on the rule and make the final adjustment by screwing the other leg in or out until the point of that leg is in the mark desired. This mode of adjusting saves the points of the dividers and the rule is also not marred.

The spring divider is a fine tool and a delight to handle, being light. The legs are of forged steel. The spring nut is quick adjusting and closes automatically. This action is positive. The thread of the nut engages the thread on the screw at the slightest pressure. When the legs are squeezed together with the hand, the nut is released and may be slid along the screw easily. The screw is of steel and is hardened to prevent wear. It is better not to grind the points on the emery wheel as these are tempered and one is liable to burn them. It is better to sharpen them when dull with a whetstone.

Survey Desirability of Weights on Drawings

Members of the special committee appointed to represent foundry producing interest and consumers of castings in the movement to have weights of castings placed on blueprints held an organization meeting at Washington, Thursday, April 8. At this meeting it was decided to send out a questionnaire under the auspices of the department of commerce to obtain sufficient information to ascertain if a favorable attitude exists in the foundry industry toward the practice of placing weights of castings on drawings sent to foundries for estimates. The questionnaire was prepared at the meeting and will be sent to foundry interests and users of foundry products in the near future.

The special committee, which met April 8, was authorized at a conference of foundry interests, users of castings, trade associations and others held Feb. 25, to make a survey of the question of weights on blueprints and other questions relating to the elimination of waste in the industry. The committee is to make a report at a general meeting of all interested which will be held in connection with the Detroit convention of the American Foundrymen's association to be held the latter part of September.

The majority of the committee favored showing weights on blueprints or were of open mind and supported action to approach the industry to get views preparatory to further action on the proposals.

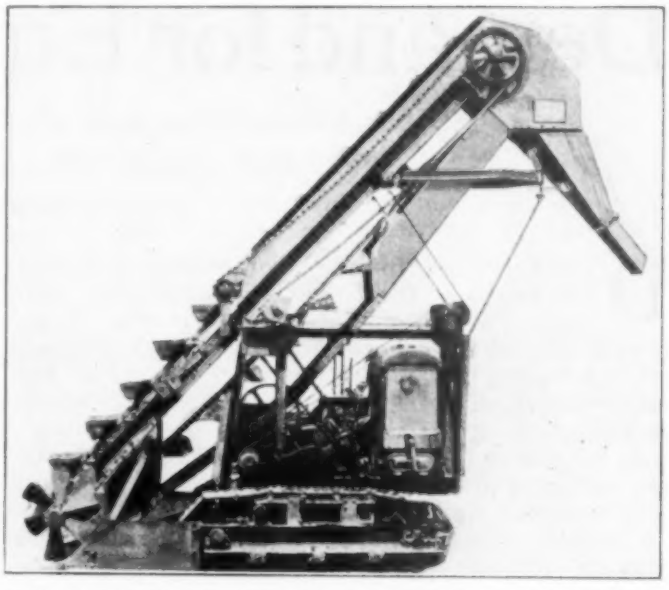
The committee, it was announced, now is as follows: H. D. Hunter, American Malleable Castings association, Dayton, O., chairman; William H. Barr, National Founders association, Buffalo; Norman C. Damon, Na-

tional Automobile chamber of commerce, Washington; W. J. Corbett, Steel Founders Society of America, Pittsburgh; A. G. Follette, American Railway association, New York; J. J. McBride, American Car & Foundry Co., New York; A. B. Root Jr., American Foundrymen's association, Boston; Thomas E. Durban, Erie City Iron Works, Erie, Pa, and A. G. Hopcraft, National Association of Purchasing Agents, Cleveland.

W. L. Chandler, New York, representing the National Association of Purchasing Agents, also was present. The committee meeting was held with W. Chattin Wetherill, director of the national metals utilization committee, and officials of the simplified practice division of the department of commerce.

Builds Crawler Type Bucket Loader

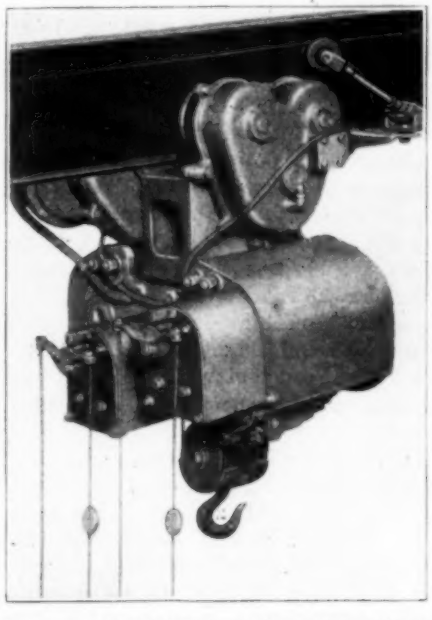
A crawler loader designed to handle crushed stone, gravel, sand, phosphate and similar materials at a rapid rate, recently has been introduced by the Link-Belt Co., Chicago. The driving, operation and care of the new device may be handled by one man. The loader is made up of four units, namely, the elevator, the chassis, the power plant and the crawler. The loader has a capacity of 1¾ cubic yards per minute with uniform feed. The buckets are of special design with reinforced edges to reduce wear and are carried on double strands of malleable iron and steel chain. Head and foot sprockets are made of manganese steel in two parts, and are clamped on hexagonal steel shafts. The driving wheel on the elevator head shaft has a safety breaking pin. The chute at the head of the elevator is of the swiveling type and operates through an angle of 180 degrees. The feeder consists of manganese steel paddles bolted to the hexagonal steel shaft, and arranged to produce a steady feed of materials to the buckets. Feeder adjustment and controlling mechanism both are controlled by a hand wheel within reached of the operator.



THE LOADER IS EQUIPPED WITH A FEEDER WHICH CARRIES THE MATERIALS TO THE BUCKETS

The chassis is made of heavy angles, plates and channels, securely riveted together. The rear of the chassis is supported on a large steel bracket casting, which is pinned to the rear axle. Power is supplied by a gasoline engine of 30 horsepower and running at 1200 revolutions per minute, or by electric motor equipment. The truck transmission has three speeds. The various drives are through roller chains running on steel sprockets. The crawler is made of channel and plate riveted together. The shoes and sprockets are specially designed to be self cleaning. Forced lubrication is used.

THE WIRE MESH IS CRIMPED



THE ELECTRIC HOIST IS EQUIPPED WITH A MOTOR DRIVEN TROLLEY

Applies Trolley to Hoist

A new motor driven trolley has been developed by the American Engineering Co., Philadelphia, for use with its ½ and 1-ton electric hoists, which previously have been built in the bolt suspension or plain trolley types. The trolleys may be supplied with travel speeds of either 80 or 120 feet per minute, and may be controlled accurately. Remote control may be used if desired. Any hoist of this type now in service may be converted into a motor trolley hoist by adding a new trolley. A 22-inch headroom is required for the hoist and trolley. The trolley is built ruggedly and maximum traction is obtained by driving all four wheels. The three main castings from which the load is suspended are steel. The spur gear drive is enclosed and runs in an oil bath, and roller bearings are used on all shafts. The motor, which may be removed easily when necessary, may be supplied for either direct or alternating current. A view of the hoist and trolley is shown in the illustration.

Sifts Sand Quickly

The J. S. McCormick Co., Pittsburgh, recently has developed a new type of sand riddle for use in the foundry. As may be noted in the accompanying illustration, galvanized wire of a special design is used in the bottom of the riddle. The wire mesh is crimped or pyramided. It is claimed that wire in this shape presents a side surface to the sand in the riddle, and that this side surface cuts into the sand and sifts it quickly, finely and easily. The riddle rim is wood.

To Discuss Refractories

As recently announced, the annual meeting of the American Refractories institute will be held at the Bellevue-Stratford hotel, Philadelphia, on May 12. Six technical papers will be presented on various phases of refractories. Invitations to attend this meeting are extended to all interested.

Demand for Equipment Varies

Pittsburgh District Leads in Market Activity as Other Centers Feel Effect of Hesitating Tendency on the Part of Foundrymen To Close on Machines

DEMAND for foundry equipment is spotty throughout the various distributing centers. While manufacturers in the Pittsburgh district have experienced a period of brisk buying during the month, sales in several of the other distributing centers show a slight decline in volume in April compared with the total realized in March. Buyers in the Chicago territory are delaying their purchases, due, it is thought, to a reported slackening in the operating capacity of certain classes of foundries in the city and surrounding territory. Sales of molding machines are leading the market, and manufacturers of this line of equipment feel that the business will continue.

Inquiries are heavy and are not confined to any special line. Considerable equipment of various types has been installed in cleaning departments recently and sand handling and conditioning machinery is gaining considerable attention. A large amount of repair work is being done. Makers of equipment generally feel that the business for May should measure favorably with the sales in April.

Molding Machines Hold Trade Interest

BUYERS in the Chicago district appear to be hesitating on closing on some lines of foundry equipment. However, inquiries are heavy. The W. W. Sly Mfg. Co., Cleveland, has sold a sandblast mill to the Hercules Corp., Evansville, Ind., and two tumbling barrels to the Ypsilanti Foundry Co., Ypsilanti, Mich., while the Beardsley & Piper Co., Chicago, has disposed of a tractor type sand throwing machine to the Trinity Valley Iron & Steel Co., Forth Worth, Texas. The American Car & Foundry Co., Madison, Ill., has ordered a shakeout bail and the Columbia Sanitary Mfg. Co., Louisville, Ky., and the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., have purchased vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Sandblast and dust arrester equipment has been secured by the Lipman Refrigeration Co., Beloit, Wis., the Union Iron Works, Spokane, Wash., and the Lufkin Foundry Co., Lufkin, Texas, and dust arrester equipment by the Frank Foundries Corp., Moline, Ill., from the Pangborn Corp., Hagerstown, Md. The Hansell-Elcock Co., Chicago, and the Cape Girardeau Foundry Co., Cape Girardeau, Mo., have ordered sand separating and blending machines from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. Two molding machines have been secured by the Omaha Steel Works, Omaha, Nebr., and one machine by the National Brake & Electric Co., Milwaukee, from the Herman Pneumatic Machine Co., Zelienople, Pa. The Whiting Corp., Harvey, Ill., has sold two cupolas to the Piston Ring Co., Muskegon, Mich., one cupola together with other foundry equipment including a tumbling barrel, core oven, ladles, etc., to the Edison Electrical Appliance Co., Chicago, and a tumbling mill with combination clutch and brake to the Frank Foundries Corp., Moline, Ill. The Chicago Steel Foundry Co., Chicago, has purchased an annealing and heat treating furnace from the Electric Furnace Co., Salem, O. The St. Johns Foundry Co., St. Johns, Mich., has purchased a cupola from the J. W. Paxson Co., Philadelphia.

Sales Fall Slightly

ALTHOUGH a number of manufacturers of foundry equipment in the Cleveland territory have experienced a slight falling in sales in April as compared with March, a few builders have secured orders in a volume equal to that of the preceding month. Inquiries for practically all lines are numerous and many foundries seem inclined to enter the market. The Ferro Machine & Foundry Co., Cleveland, and the Dayton Malleable Iron Co., Dayton, O., have purchased sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. Sandblast equipment has been sold to the National Stove Co., Lorain, O., and the Ford Motor Co., Detroit, and sandblast and dust arrester equipment to the American Radiator Co., Buffalo, by the Pangborn Corp., Hagerstown, Md. The Gartland - Haswell - Rentschler Foundry Co., Dayton, and the Whitehead & Kales Co., River Rouge, Mich., have ordered shakeout bails, the Ferro Machine & Foundry Co., Cleveland, has secured a core knockout machine and the U. S. Radiator Corp., Detroit, and the Fox Furnace Co., Elyria, O., have purchased vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Fremont Foundry Co., Fremont, O., has ordered a tractor type sand throwing machine, the Henry Furnace Co., Cleveland, has closed on a tractor type machine with jibs, and the Modern Foundry Co., Cincinnati, has purchased a locomotive sand throwing machine from the Beardsley & Piper Co., Chicago. The Gartland-Haswell-Rentschler Foundry Co., Dayton, has ordered a sandblast room with turntable and dust arrester equipment, the Dayton Malleable Iron Co., Dayton, two tumbling mills, the Allen Mfg. Co., Nashville, Tenn., a sandblast mill and dust arrester equipment, the Ohio Malleable Iron Co., Columbus, O., a tumbling mill, the General Electric Co., Erie, Pa., a sandblast room and the Buckeye Steel Castings Co., Columbus, dust arrester equipment, from the W. W. Sly Mfg. Co., Cleveland. The American Radiator Co., Buffalo, has purchased three molding machines and the Niagara Machine & Tool Works, Buffalo, has taken one machine from the Herman Pneumatic Machine Co., Zelienople, Pa. The Ford Motor Co., Detroit, has closed on two special 120-inch type cupolas with charging machines with the Whiting Corp., Harvey, Ill. The Farrell Cheek Foundry Co., Sandusky, O., has obtained a 7500-pound steel helical worm geared ladle from the Whiting Corp. The Ohio Steel Foundry Co., Lima, O., has ordered a large roll and blending machine from the Standard Sand & Machine Co., Cleve-

land. The National Foundry Co., Erie, Pa., is expected to buy some equipment soon for a small addition. The Aetna Foundry & Machine Co., Warren, O., has closed on a 10-ton electric traveling crane with the Northern Engineering Works, Detroit. Dodge Bros., Detroit, have purchased sandblast tumbling barrels from the J. W. Paxson Co., Philadelphia.

Eastern Business Declines

THE consensus of opinion of foundry equipment sellers in the New York Metropolitan district appears to be that business has shown a falling off from March. Outstanding orders have been noted in only a few instances and from the standpoint of number they aggregated a lesser total. Among the large buyers is the Ford Motor Co., which is reported to have purchased considerable equipment for a plant at Troy, N. Y. The Elmira Foundry Co., Elmira, N. Y., has closed on dust arrester equipment with the W. W. Sly Mfg. Co., Cleveland, and the New York Air Brake Co., Watertown, N. Y., has purchased vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Sandblast and dust arrester equipment has been ordered by the General Railway Signal Co., Rochester, N. Y., and sandblast equipment by the Morris Machine Works, Baldwinsville, N. Y., from the Pangborn Corp., Hagerstown, Md. The Gamon Meter Co., Newark, N. J., has taken a sand separator and blender from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. That manufacturer also has sold a machine to Moll & Rohwer, Neumunster-Den, Schleswig, Germany. The Beardsley & Piper Co., Chicago, has sold a tractor type sand throwing machine to Metters, Ltd., Sydney, Australia. The National Radiator Co. has awarded steel for foundry extensions at Johnstown, Pa., and the Bethlehem Shipbuilding Corp., Elizabeth, N. J., contemplates the erection of a foundry to replace one recently damaged by fire. The Alan Wood Iron & Steel Co., Philadelphia, is reported seriously to be contemplating the erection of a cast iron pipe plant, adjacent to its blast furnaces at Swedeland, Pa. The company is said to be planning on an initial production of 250 tons a day.

New England Market Spotty

RECENT foundry equipment sales have been spotty. Several new projects have accounted for a number of molding machine sales and some other standard equipment. The Bradley & Hubbard Mfg. Co., Meriden, Conn., and the Hood Rubber Co., Watertown, Mass., have bought sand separators and blenders from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. The Hood Rubber Co. also has purchased sandblast and dust arrester equipment from the Pangborn Corp., Hagerstown, Md. A sandblast mill and cabinet has been ordered by the General Electric Co., Lynn, Mass., from the W. W. Sly Mfg. Co., Cleveland. The Hartford Foundry Corp., Wethersfield, Conn., has been buying and still is in the market. A new foundry at East Haven, Conn., has bought molding machines and a brass foundry starting at New London, Conn., has been in the market for a list of miscellaneous material. Cranes are moving slowly and several projects have been postponed.

Buying Heavy in Pittsburgh

THOSE who note a falling off in business in the past two or three weeks are not in the foundry equipment selling trade, according to many of those affiliated with it in the Pittsburgh area. However, a rule has its exceptions, and one or two local sellers have experienced a lull in the buying rate within the past two weeks but they continue to report that inquiries keep up splendidly. One item of interest they also note is the fact that repair part orders represent a large total, and they expect that when all repairs have been made, additional equipment orders will be placed. The Herman Pneumatic Machine Co. reports that even in war times the molding machine business was not more extensive. It is averaging more than double the demand a year ago this time. Among latest purchases made from that company are included two by the Canadian Westinghouse Co., Hamilton, Ont., and one by the McWayne Cast Iron Pipe Co., Birmingham, Ala. The Enterprise Bronze Co., Pittsburgh, has been buying small supplies for a nonferrous foundry. The Pittsburgh Engineering Co., Jeannette, Pa., purchased a cupola from the Whiting Corp., Harvey, Ill. The latter interest also has sold several core oven cars to the Richmond Radiator Co., Uniontown, Pa., two special structural type cupolas with all accessories to the King Co., Sheffield, Ala., while the Crane Enamelware Co., Chattanooga, Tenn., bought several 2500-pound ladles. Tumbling mills have been secured by the Pittsburgh Malleable Iron Co., Pittsburgh, from the W. W. Sly Mfg. Co., Cleveland. The Bethlehem Steel Co., Bethlehem, Pa., has purchased a double belt stationary type sand throwing machine and the Bessemer Gas Engine Co., Grove City, Pa., has taken a portable type machine from the Beardsley & Piper Co., Chicago. The Pressed Steel Car Co., McKees Rocks, Pa., has ordered a sand mixing machine from the National Engineering Co., Chicago. The inquiry for a 10-ton electric crane for Scottdale, Pa., plant of the United States Cast Iron Pipe & Foundry Co., has been withdrawn.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Keystone Foundry Co., Plymouth, Ind., recently was placed in operation after being idle for several months.

Minneapolis Threshing Machine Co., Hopkins street, Minneapolis, is building a 2-story plant at Hopkins, Minn., 60 x 100 feet.

Wedge Mechanical House-Heating Furnace Co., Philadelphia, has been incorporated with $500,000 capital to manufacture furnaces, heaters, boilers and stokers by Franklin W. Wedge, 215 Iona avenue, Narberth, Pa., George W. Wilmot, William F. Otto and Charles G. Black.

Chattanooga Implement Mfg. Co., Chattanooga, Tenn., will build two 1-story additions each 55 x 170 feet.

Foster Machine Co., Westfield, Mass., South Broad street, will build an addition to its plant.

Dobbie Foundry & Machine Co., Seneca Falls, N. Y., J. Dobbie Sr., manager, will build a 1-story structural shop 80 x 200 feet. General contract to Laur & Mack, 1400 College avenue.

Bethlehem Shipbuilding Corp., Elizabeth, N. J., Eric Ewertz superintendent, will build a 1-story foundry to replace fire loss.

Progressive Brass Mfg. Co., Kansas City, Mo., 1711 Cherry street, E. J. Thomas manager, is having plans made for a 1-story addition.

Aacone Engineering Corp., North Plainfield, N. J., Edward W. Lawler president, has bought a 10-acre site at Metuchen, N. J., and

will build 1-story machine shop at once followed by foundry later, for manufacture of pebble mills.

Valley Iron Works, Appleton, Wis., has purchased 20 acres adjoining its plant and will start expansion construction at once.

Pequot Brass Foundry, Norwich, Conn., is now located on the Hallville district property which it recently purchased.

Keeler Brass Co., Godfrey avenue, Grand Rapids, Mich., will build a 2-story addition furnishing 40,000 square feet of space.

American Seating Co., Grand Rapids, Mich., H. M. Taliferro vice president, 901 Northwest Broadway, will build a 4-story manufacturing plant.

Conemaugh Iron Works, Blairsville, Pa., has resumed operations after considerable remodeling and reconstruction, following a fire in Sept., 1925.

C. C. Collins Co., 250 Poplar street, Memphis, Tenn., plans construction of foundry and machine shop plant for the manufacture of special type of hoisting machines.

Century Electric Co., St. Louis, manufacturer of electrical supplies, will build a 2-story foundry 240 x 400 feet in the Mill creek industrial district.

Newark Stove Co., Elizabeth, N. J., has been incorporated with $100,000 capital by Helen Bauman, Martin Kohngut and Samuel Freeman. Martin Kohngut, Elizabeth, is attorney.

Holland Steel Corp., Holland, Mich., has been incorporated with $50,000 capital and 1000 shares no par value by John E. Telling, and T. F. Whelan.

Moline Foundry & Machine Co., Moline, Ill., will build a 3-story foundry and machine shop at Fifth street and Third avenue, 70 x 100 feet. S. S. Hoffman is president.

Kuhns Bros., Dayton, O., have let general contract to Shook & Billiter, 810 Schwind building, for a 1-story foundry addition, 70 x 200 feet.

Mechanical Pattern Works Inc., Los Angeles, has changed its name to Mechanical Pattern & Foundry Co. Inc., and has moved its plant to 4545 Pacific avenue.

Blue Valley Foundry & Pattern Works, Twelfth street and Bristol avenue, Kansas City, Mo., has bought 100 feet frontage adjoining its plant and will add to its buildings.

Milwaukee Brass Specialty Co., 3200 Senator avenue, Milwaukee, will build a new foundry and machine shop 40 x 56 x 104 feet at 1321 Thirtieth street. General contract to Byrne Bros., 3110 Burleigh street.

Otis-Sawyer Boiler & Foundry Co., Oswego, N. Y., William Sawyer manager, will build a 1-story boiler shop and foundry 50 x 50 and 80 x 120 feet. General contract let to Peter Raby Construction Co.

Ladel Truck & Foundry Co., New Philadelphia, O., has been incorporated with $100,000 capital by N. W. Judkins, R. W. Emerson, John Mauer, A. L. Schwab and R. W. Rutledge.

Houston Steel & Foundry Co., Houston, Tex., has been incorporated with $225,000 capital to build a foundry plant by L. R. Bryan, Houston and T. C. Hicks and E. B. Stitts, Chicago.

Flint Foundry Co., Flint, Mich., J. U. Barrington president, 802 West Kearsley street, has let general contract to William Bilsky, 716 Payne street, for a 1-story foundry addition. (Noted Dec. 1.)

B. & R. Brass Foundry, Newark, N. J., has been incorporated with $125,000 capital by Charles Basner Hyman Basner, Brooklyn; Aaron Rose, Newark. George & Samuel Cohen, Newark, are attorneys.

Acme Foundry & Machine Co., Coffeyville, Kans., has organized the Acme Foundry & Machine Co. of Oklahoma and has started operations of its machine shop at Blackwell, Okla. the pattern shop and foundry to be started about May 1. Mark D. Mitchell is president, C. M. Hodshire vice president, R. K. Graham secretary and E. L. Graham treasurer and general manager. (Noted Feb. 15.)

Newark Pattern Works, Newark, N. J., recently incorporated with $125,000 capital, has taken over the existing pattern works and foundry business of Henry L. Rubovitz and C. E. Rubovitz. (Noted March 15.)

Modern Brass Foundry Inc., Los Angeles, 2213 Compton avenue, has been incorporated with $50,000 capital to manufacture bronze, brass and aluminum castings. Allen Cohn is secretary. Plant will be built later.

Zenith Foundry Co., West Allis, Wis., has been organized to take over and operate the West Allis Iron Works. W. R. Tanner, E. T. Freeman and Clarence H. Mueller head the new company.

Detroit & Michigan Stove Co., Detroit, William T. Barbour manager, 6900 East Jefferson avenue, has let contract to Walbridge Aldinger Co., 2356 Penobscot building for 1-story addition 60 x 140 feet. (Noted March 15.)

Pelton Steel Casting Co., Milwaukee, manufacturers of electric processed steel castings, recently reorganized, has elected Arthur J. Ehne president, T. E. Ward vice president, H. A. Leekley vice president and Allen M. Slichter secretary.

Crucible Steel Casting Co., Milwaukee, will start production in its new foundry about May 15, with capacity of 400 tons per day, doubling the output of its former plant. The old foundry will be placed on the market when the new plant is occupied. Equipment will include two electric furnaces and complete electric annealing equipment. Albert C. Lange is president and general manager. (Noted March 1.)

Leininger-Krause Foundry Co., 3214 Vliet street, Milwaukee, manufacturer of brass and bronze castings, which started in business recently, is specializing on church and art castings.

Detroit Stoker Co., Monroe, Mich., has started operations in its new foundry. The foundry, pattern shop and pattern storage add about 25,000 square feet to the former plant. (Noted April 1.)

Springfield Foundry Co., Springfield, Mass., did not suffer a loss from fire, as reported in the March 1 issue of THE FOUNDRY. The property in which the fire occurred is owned by the firm, but its foundry is located in another section of the city.

Peoria Foundry Co., Peoria, Ill., has been bought by the H. M. Dietrick Co., for which it has been making castings as a large part of its business. Officers of the new holding company are H. M. Dietrick president, Joseph F. Hadank vice president, Lawrence Ryan secretary and Louis Hosbein treasurer.

American Manganese Bronze Co., Philadelphia, has reorganized and consolidated its organization under one management, T. H. Addie, vice president and treasurer, being elected president and general manager. The company specializes in propeller wheels water turbine runners, bronze castings and forgings, acid valves and other acid-resisting alloys.

New Trade Publications

TRANSPORTATION—A discussion of man power and mechanical means of moving materials through the shop, is contained in a booklet issued by the Clark Tructractor Co., Buchanan, Mich.

STEEL SASH—Continuous sash for the modern well-lighted shop is described in the catalog published by David Lupton's Sons Co., Philadelphia. Methods of manufacture, types and roof design also are shown.

PUMPS—Centrifugal pumps for various kinds of service are shown in a pamphlet issued by the Pennsylvania Pump & Compressor Co., Easton, Pa.

WELDING & CUTTING—Various kinds of welding and cutting equipment and accessories are shown in a catalog distributed by the International Oxygen Co., Newark, N. J.

TRANSPORTATION—Tramrail systems to facilitate the movement of materials around the plant are described in a folder published by the Cleveland Crane & Engineering Co., Wickliffe, O. The systems are operated either by hand or electrically.

SWITCH RECEPTACLES—Safety circuit-breaking plugs and receptacles for connecting portable electric machines to the power line in the shop are shown in a catalog issued by the Crouse-Hinds Co., Syracuse, N. Y. The plugs and receptacles are designed to prevent short circuits and to smother arcs.

FLASKS—Steel flasks of various sizes and forms are illustrated in the catalog recently mailed by the Shanafelt Mfg. Co., Canton, O. The flasks are of one piece welded construction and built for heavy duty.

POWER—The General Electric Co., Schenectady, N. Y., has issued a catalog on the power factor and means for its improvement. Power factor is defined and the several methods of improving a low power factor are described. These methods are by using the proper type of induction motor, use of cynchronous motors and use of capacitators.

AIR COMPRESSORS—A folder showing various sized compressors for small, moderate and large air capacity demands is being issued by the Chicago Pneumatic Tool Co., New York.

ELECTRIC CONDUITS—Crouse-Hinds Co., Syracuse, N. Y., has issued several folders describing various types of conduits manufactured by this firm. Illustrations, sizes and prices are given.

DIE CASTINGS—A brief review of the process including valuable engineering and metallurgical data are given in a catalog published by the Doehler Die-Casting Co., Brooklyn, N. Y. The catalog is of pocket size and well illustrated with photographs of castings turned by this process.

STOKER—A catalog has been issued by the Combustion Engineering Corp., New York, describing its forced draft stoker, developed recently to meet certain conditions, especially the use of middle west bituminous coals. Details of the stokers are shown and cross-section diagrams of various settings for using a variety of fuels.

FOUNDRY REFRACTORIES—Problems of refractories in the foundry are treated at length in a booklet by the Quigley Furnace Specialties Co. Inc., New York. The questions of refractory linings, bonding fire brick, daubing, ladle lining, bung lining and many others are considered and suggestions made for the use of this company's refractory material. The booklet is well illustrated and considerable data are presented.